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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A NEW vibrating sheep-shearer has been constructed, and an extensive plant put down in Sheffield for the manufacture of the appliance. By its aid a long-woolled horned sheep, one of the most difficult animals to shear, can be denuded of its wool in from two and a half to three minutes.

* *

A carpet costing £200,000 decorates the treasure room of the Maharajah of Baroda. It is about 10 ft. by 6 ft. in size, and is made entirely of strings of pure pearls, with a centre and corner circles of diamonds. This useless article took three years to make, and was one of the mad freaks of Khande Rao, who intended to send it to Mecca to please a Mohammedan lady.

* *

The superior conductivity of mercury over water renders it more rapid in action as a cobling agent, and it is, therefore, suggested as a medium for quenching small drills and other tools when heated for hardening; the object plunged into the liquid metal must be held down in it, as, if released, it would float, mercury having about twice the density of steel.

* *

As a proof of the Japanese aptness as engineers, we note a recently invented patent recoil mounting for three- and six-pounder Hotchkiss breech-loading guns. Two prominent English engineers have been trying for the last three years to perfect an invention for answering the same purpose, viz.—operating the breech mechanism so that the gun is unloaded automatically.

* *

Engineers, gaugers, and others when testing for hole accuracy, frequently smear the mandril gauge with a fine film of oil, and, in testing, find the hole to be rather small. If the gauger would use clean tallow—which is a better lubricant than oil—he would find that the same gauge that did not go through the hole and oil will work easily with a tallow lubricant—an important difference where minute accuracy of boring is involved.

For drilling glass a drill may be made out of steel wire, getting the cutting edge like that of a stone drill, with the corners square and sharp. The drill is heated to a white heat, and dropped into cold water. It is then rotated in a drill-stock, with the cutting edge kept wet with a solution of camphor in turpentine. By this means a hole can be cut through glass ⅜ in. thick in about one minute. If the glass is thin, fix writing paper on each side with ordinary gum.

* *

Fibre has been tried on a tramway as a material for the gearing, the wheel teeth of the train connecting the electro-motor with the running axles being arranged to run in oil; this, however, has resulted in failure through the disintegration of the fibre, and metal wheels have been substituted. The object of using the fibre was to avoid noise. It might be worth while to try hornbeam for the teeth of the gear wheels.

* *

An electric railway is projected from St. Louis to Chicago, 250 miles. This road will follow a straight line between the two cities, and will be constructed in six months, at a cost of $6,600,000. The cars will run on the trolley system by electricity, each car having a machine with a man in attendance. The speed is to be 100 miles per hour, the distance from St. Louis to the World's Fair being thus covered in two and a half hours.

* *

Bolts which have to sustain any great tensile strain should have their threads properly cut in the lathe. Threads formed by stocks and dies get their form partly by the cutting action and partly by the compression of the dies, hence the threads that are cut in the lathe *out of the* solid, as it were, are the best on account of the fibre of the material remaining intact. This would not be the case where part of the thread had been pressed into shape. The same rule should be observed with nuts that have to bear a great shearing strain in comparison to the sectional area of the thread.

* *

A fly-wheel that recently burst in America from the effect of centrifugal force upon its rim has been replaced by a wooden one. Wood has the advantage of possessing a greater tensile resistance, weight for weight, than metal, and it is found—after making allowances for additional weight of junction bolts and loss by joints—that the ratio of the limiting, or bursting, velocities of wheels made of ash is to that of iron as 2·63 to 1, and the ratio for hornbeam as 2·95 to 1. The disadvantage of wood for this purpose lies in the amount of labour consumed in building up the wheel. Steel is twice as strong as cast-iron in its resistance to centrifugal force.

* *

Satisfactory experiments have been made on copper-plating sheet zinc for building purposes. The zinc combines well with copper, and can be coated by either galvanic or ordinary process. One part of refined verdigris and twelve parts tartar are dissolved in twenty-four parts of water, and, when boiling, three or four parts of Spanish white are added. The dark blue liquid is filtered off from the precipitate formed, and can be used either as a bath for the sheet zinc or for the production of a copper-plating paste. To coat an immovable zinc object with copper, the article, after being cleaned, is painted with the copper solution and chalk compound, and, after drying, brushed.

* *

Instantaneous photographs of the lips of a speaker, reproduced so that a deaf-mute can understand what has been said, are to be improved by a process and an invention called the "phonoscope." The changes of the lips in speaking are so rapid that fifteen photographs a second are required to give a good result. Moreover, several sets of images for the same phase are taken, so that nothing essential should be omitted. The whole head and bust of the speaker is photographed so as to get the benefit of the expression. In the phonoscope the positives are arranged around the periphery of a disc which is rapidly turned by a handle. A second disc, having a single window in it just opposite the plates, is also rotated by the same handle, but at a much higher speed than the other. A beam of sunlight illuminates the plates from behind. This all perfected, we shall possess veritable "speaking likenesses"; the family album will contain photographs which will not only smile, but speak, or appear to speak.

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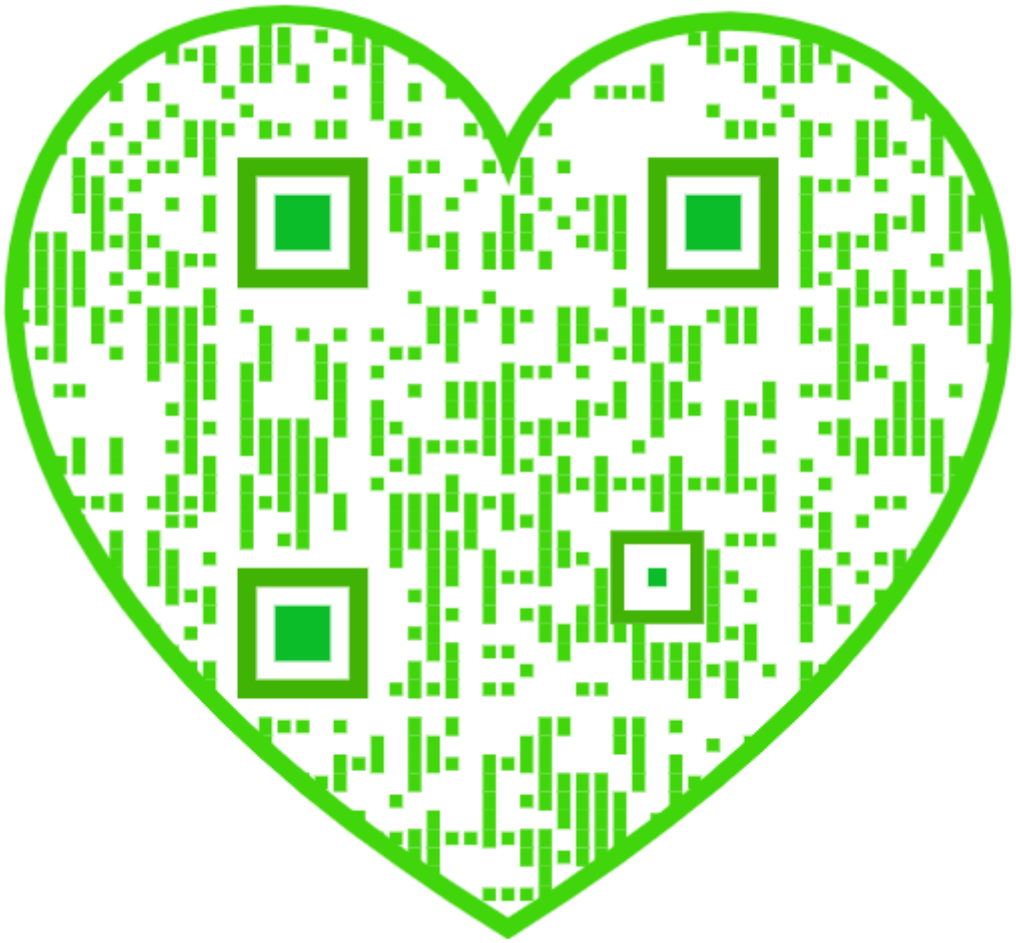


COUNTRY CARPENTRY: A COW LODGE OF WOOD.

BY CHOPSTICK.

In my paper in No. 169 I described the framing of cow lodge, and I cannot do better than devote this chapter to the inside fittings of the same; but before commencing on them we will cover the woodwork outside, as it was left as a skeleton. This can be described in a few words, as it will be weather-boarded, as it is called; and though familiar enough to the country carpenter in the south, my northern readers will most likely never have seen it. And I would recommend them to adopt the fashion at once, as there is nothing to beat it for warmth, dryness, cheapness, or durability.

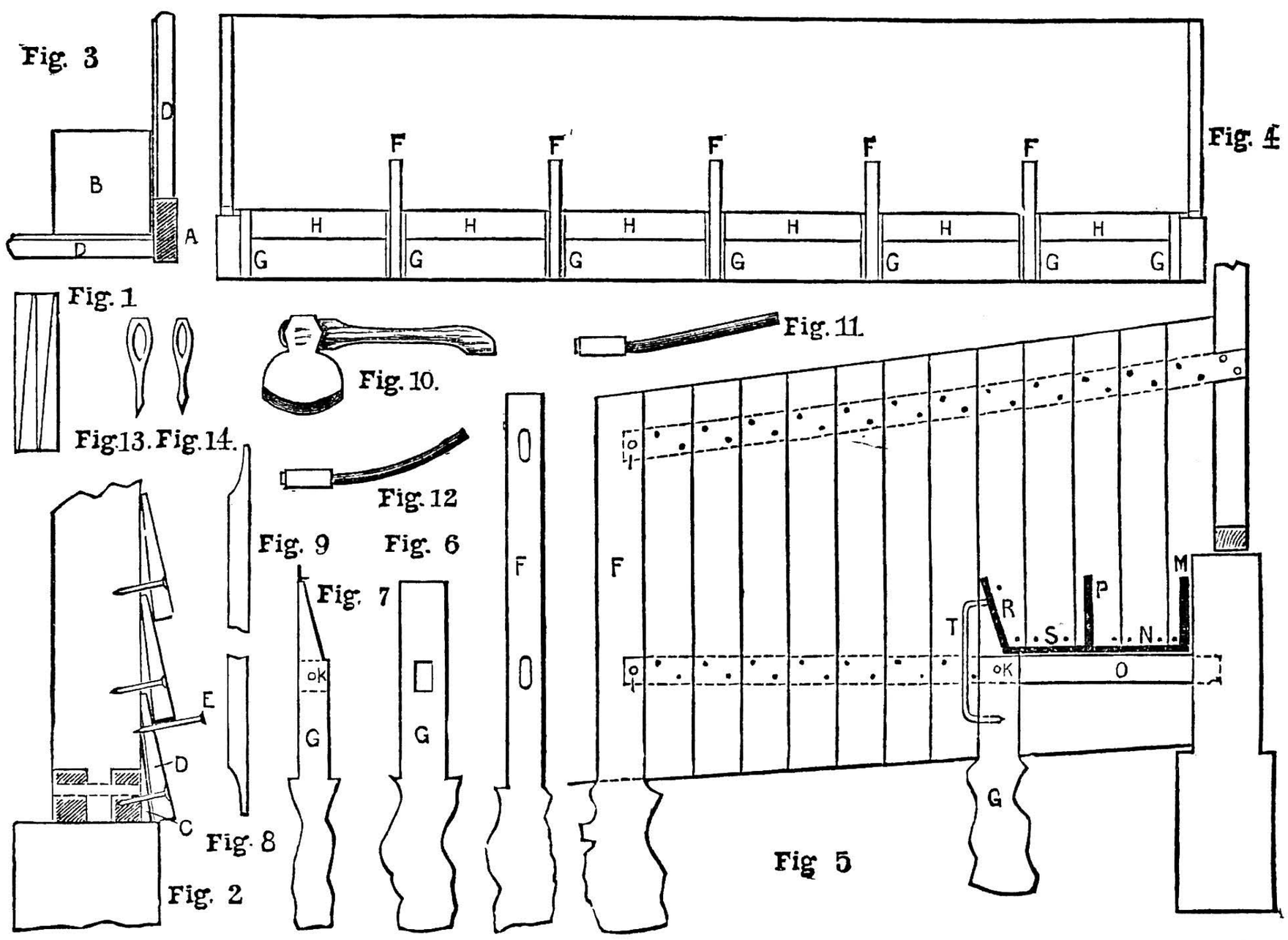
The boarding is cut feather-edged, as it is called—that is, about 1 in. thick at one edge and only ¼ in. at the other. The usual way is to cut it out of 7 in. by 2½ in. battens (red deal, mind; not spruce), each batten making four boards, by cutting it as shown in Fig. 1, which is a section of batten after being sawn. Before commencing boarding, the "stops" must be put on each post. These are shown in section in Fig. 3 at A, B being the post. They are usually about 3 in. by 1½ in.; and by nailing them on the post, so as to project 1½ in. over one side, they form the stops for the boards running both ways.

Having fixed all the stops, cut out some taper pieces about 6 in. long, tapering from ¾ in. to nothing, and nail them on the sills at intervals of about 18 in. These are to cant out the bottom board (one is shown in its place at C, Fig. 2). When these are fixed the bottom board can be nailed on, keeping the side which is square with the thickest edge inside—that is, towards the framework—and placing the nails about 1 in. from bottom edge only. Do not nail the top edge. Of course, the boards will need splicing, as they will not be long enough to reach the whole length of building: a square butt-joint will do, but it must be on a quartering, so that both ends can be nailed securely; and do not splice two following boards at the same place. We have now fixed one board the whole length of the lodge (as D, Fig. 2). Now measure up 5¾ in. from bottom edge of board, and stick in a nail temporarily (as at E, Fig. 2) at three or four places in the length of lodge, having one about 1 ft. from each end, and the others about equal distances between. These are called "tack" nails, and are used to lay the next board on while it is marked to the length, and afterwards nailed. Each successive board is put on in the same way, drawing the "tack" nails out as we go up; and when you once get into the way of working, it is astonishing how much ground—or, perhaps I should say, how much framework—can be covered in a day. In nailing the boards on, the nails should be placed so as to just clear the edge of the board underneath, as if they are driven through both boards, and then the boards shrink, one or both is bound to split; whereas, if only one is nailed through, it gives a chance for them to shrink or swell without doing any damage.

I think this is sufficient instructions for the weather-boarding; so we will proceed with the inside stalls and mangers, which, though simple enough to those who have been brought up to it, as I have, would be rather perplexing to a novice who had to take his instructions from one of the old style of farmers, whose opinion of him would not be very flattering if he did not understand at once what was required of him.

The lodges are usually divided into spaces to hold two bullocks each: about 5 ft. being the proper distance, though some will have larger stalls. They should not be smaller, at any rate; and as the lodge under consideration is 30 ft. long, it will make six stalls of 5 ft. each, thus requiring five "pens," as the divisions are called. Fig. 4 shows the lodge divided into six stalls, F being the pen-posts, G the manger-posts, and H the manger. Fig. 5 shows one pen, and also a section of manger. It is not shown to scale, but will give a good idea of the look of the thing itself. The first thing will be to prepare the posts, and these I will suppose to be sawn out; though, as they often have to be chopped up, my paper on fencing will suffice for all jobs where that is the case, and I will not enter into it now. Therefore, take one of the long posts, and set out a mortise at 6 in. from the top, and another 2 ft. lower down (2 ft. between the mortises); then run a centre line down the *edge* of post, and bore two 1¼ in. holes for each mortise, placing the point of auger on the centre line, and letting the hole just touch the cross lines; then cut out the wood between the holes, and the mortises are finished (see Fig. 6). The size of mortises must be obtained by measuring width of rails, which is usually 4 in.; but do not get them too tight. All the long posts must be mortised in the same way, and a ¾ in. hole bored through each mortise (see Fig. 5, I, which also shows how far the posts should be mortised in).

The short posts must now be prepared. First measure the width of manger-board, which will most likely be 11 in.; if so, make the mortise that distance down from the top, and through the posts flatways—not in the edge, as before. These mortises must also be large enough for the rails to slide through easily (see Fig. 7). When all these are mortised, and pin-holes bored (K, Fig. 5) through centre of mortise, they must be cut as in Fig. 8. The bevel should be about 3 in. and the top edge at L about ¾ in., letting the bottom come what it will. The bevel in all the posts must be alike, or the manger will look bad when finished. The dotted lines in Fig. 8 show the mortise. Besides the five posts for pens, we also require two smaller ones for the ends, to fix the manger to. These must be mortised in the same way, but with small mortise, as in the pen-posts, F; but the top will require cutting the same as the other manger-posts. The rails must now be cut to the right length (the top ones) and "ended"—about 6 ft. 6 in. will be right—and they are chopped (as in Fig. 9) with the axe; but it must be noticed before doing this where the pens come, as some of the rails may come to mortise into



Cow Lodge of Wood. Fig. 1.—Batten cut into Weather-boarding. Fig. 2.—Detail of Weather-boarding when fixed. Fig. 3.—Plan of ditto, showing Stop. Fig. 4.—Elevation of Stalls and Manger. Fig. 5.—Side Elevation of Pen, showing Section of Manger. Fig. 6.—Pen-Post. Fig. 7.—Manger-Post (Front). Fig. 8.—Ditto, ditto (Side). Fig. 9.—Rail, showing Ends. Fig. 10.—Broad Axe. Fig. 11.—Right Shape of Handle (Sideways). Fig. 12.—Wrong Shape of ditto. Fig. 13.—Section of Axe, showing Edge ground the wrong way. Fig. 14.—Ditto, ditto, with Edge ground the right way. A, Stop fixed to Corner-Post; B, Corner-Post; C, Taper Piece to cant Bottom Board; D, Weather-board; E, Tack Nail; F, Pen-Posts; G, Manger-Posts; H, Manger; I, Pins in Pen-Posts; K, Ditto in Manger-Posts; L, Bevel on Manger-Posts; M, Back-board of Manger; N, Bottom of Back Manger; O, Bottom Rail; P, Division Board of Manger; R, Front of Manger; S, Bottom of Front Manger; T, Iron Slide.

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the quartering, and some to nail on. These latter will only require "ending" at one end. The bottom rails will fix in the brickwork at one end, so that they need not be cut yet to length, but can be "ended" at one end only. A few words as to how this "ending" should be done will not be out of place here, as, though it is easy enough to do it right, I never yet saw a novice who could do it properly. When done as it ought to be, the rail should fit the mortise the whole distance in, which it will do if cut as I have drawn it; but the tendency of most people is to cut it wedge-shaped, which is never so well, as there is a danger of splitting the post when driving it on, and, at the same time, it fits the mortise only at the extreme outside, and the consequence is, the pin has to bear the stress which should be borne by the rail. Another thing is, that while it is quite possible to make a bad job with a proper tool, it is quite impossible to make a good job with a bad tool. I have therefore, in Figs. 10 to 14, shown the difference between a good and a bad tool—in this case the broad axe, one of the most necessary tools for the country carpenter. The proper shape of this tool is shown in Fig. 10—both the handle and the axe itself; the weight of the latter should be about 5 lb., and the length of the former 2 ft. over all. The handle should be bent sideways (as in Fig. 11), the bend being close to the axe-head, and *not* a continual curve (as Fig. 12); the blade of axe should be ground on both sides (as in Fig. 14), and *not* on one side only (as Fig. 13).

I will not take up more space with the reasons for this here, as they will be given in a future paper; but I think it as well to just give an idea what a proper axe is while showing how to end the rails. The holes for posts should now be dug—the top rails will give the right distance from back of lodge; one long post should then be placed in its hole, which should be deep enough to leave 4 ft. of the post out of the ground; then level across from the bottom mortise to the brick foundation, to find the place to cut the hole for that end of bottom rail. All the holes can then be cut, the courses of bricks forming a guide for height, as they will most likely be level. After these holes are all cut, measure up 3 ft., and make the mortises in quartering for top rail, where they come right; but if none of them come right for mortising into the quartering, a line must be made along the whole length, to serve as a guide to nail them to. The two pens nearest the ends of lodge can now be put up. Place the manger-post in its hole first, then slide the bottom rail through the mortise into the hole in the brickwork made for its reception; then put the pen-post in its hole, and put the top rail in its mortise at back of lodge, and push the pen-post forward, guiding the rails into the mortises at the same time. See that the post is upright both ways, also that the rails are square with back of lodge, or parallel with end of lodge. The hole can then be filled up and rammed tightly, especially at the bottom of the hole, after which the pin-holes can be bored through the rails and the pins inserted. The bottom rail must also be wedged tightly in the brickwork, keeping it out of winding with the top rail.

The manger-post can now be fixed by pinning to the rail, keeping it the right distance from the back of lodge, so that the manger-boards come right without any cutting; for instance, if the boards are 11 in. by $\frac{3}{4}$ in., as is usual, the post must be just a full 2 ft. from the brickwork to where the front of manger is fixed at the bottom. This post can now be rammed up as before, though it is not obliged to be fixed so tightly as the other, as it is impossible for it to move.

This pen is finished, and the other end one must be put up in the same way. These two will then form guides for fixing the others, so that all the posts are straight along the front and all the rails level with each other at the top. The two small manger-posts can now be put up at the ends, with a short rail on a line with the other bottom rails for bottom of manger to lay on.

The manger can be fixed next—the section in Fig. 5 is nearly sufficient explanation for this—the back-board, M, being put in first, and fixed by driving a few nails into the joints of brickwork. The bottom, N, must then be fixed close up to M, nailing it firmly to the rails, O, then the central division, P; this can be nailed to the edge of N. Now the front, R, must be nailed to the posts; and, lastly, the bottom board, S, must be fixed to the rails, and the front must also be nailed to it along the bottom edge. This last piece will require bevelling on one edge to fit the front, as it is necessary that they should fit fairly well, or the corn will fall through the joints to the ground. It will be necessary to splice all the manger-boards, as they will not be 30 ft. long. M should be spliced just in front of the rails, so that when the boards are nailed on the splicing is covered; P the same; the others can be spliced anywhere on the rails and posts respectively. End pieces must be fitted into the mangers at each end only, as the pen-boards will form the divisions.

The pen-boards must be nailed on next, commencing each pen at the long post and finishing at back of lodge. Small cleats must be nailed to bottom of manger to fix the ends of boards to. The space under manger may be left open, as it is no use to waste time and stuff in boarding it. In nailing the boards on, do not place all the nails in a line along centre of rails, but put one at the top and one at the bottom of rail in each board, as I have shown in Fig. 5. There will then be no fear of the rail splitting, which it would be likely to do in the former case. Do not cut each board to the length as they are put on, but fit them to the bottom, and leave them about 1 in. off the ground; and when all the pens are boarded, mark them off with a straight-edge and cut them all at once. This is rather hard work, but it is much the best and quickest job. The slides, T, can now be put in. They are made of round iron, and have a ring on them to which the bullocks are tied. The ring is then free to slide up or down with the movement of the animal, thus keeping the chain tight and saving many a broken leg. Two of these slides will be fixed in each pen, one in each manger-post, so that in the lodge under consideration there are twelve required.

One thing I have omitted to mention—that is, all the posts and rails should have the sharp edges chamfered off where there is nothing coming to them, as sharp edges are dangerous for cattle to lie down on.

The cow lodge is now ready for occupation, as far as the carpenter's work is concerned; and I hope that the perusal of this paper may be of some assistance to those who, like myself, have removed far from where they learnt their trade, and who find, as I have done, that they almost need to be apprenticed again, so much does the work and the methods of doing it differ in various parts of the country.

In my next paper I shall deal with the preparation and putting up of rough or farm-yard fencing; and, as I have said, I will give any needy one advice in the "Shop" columns, if they will only ask for it.

HOW TO BIND BOOKS.

BY "U. S. TINKER."

How often is it that we amateurs wish that that paper-covered book or pamphlet had a stiff cover so that it would stand up in the book-case as other books do, and also a label on its back so that we could find it without having to handle over a pile of papers, pamphlets, etc., and in a great many cases it is the bottom one! My method of binding is very simple, and a cheap paper-covered book can be made to look quite as well as the cloth-bound books; and as cheap editions of a great many desirable books (with paper covers) are now published, the amateur can easily and cheaply bind such.

My experience has proved that the best paste to use is made from "gum tragacanth," to prepare which it is only necessary to fill, say, a two-ounce wide-mouthed bottle with the gum, and then fill up with water, and let it stand a day, when you will have a paste that will spread easily, keep well, and *stick*.

The first thing to do is to remove the paper covers from the book very carefully, and also the part that covers the back which contains the label or name of book. Then take some good print or book paper, and fold it to make two or four leaves exactly the size of book. Place similar fly-leaves on front and back of book, and paste the edge (back) on the book. Then take an awl, if book is not over $\frac{1}{2}$ in. thick, and put two or three holes about $\frac{3}{16}$ in. from back; or if it is put together with staples, as is quite common now, put the holes at same distance from back as they are. If the book is up to 1 in. thick, bore holes with a small broad gimlet or twist drill.

Now thread a large needle with some strong tow string, and draw it through each hole, letting it project about $1\frac{1}{2}$ in. in front and back of book; fray out each end, and paste it down to fly-leaves. Procure some straw- or paste-board about $\frac{1}{16}$ in. thick, and cut it exactly the size of book lengthways, and wide enough to just come to the holes through which the strings pass; then paste one on each side of book. For the back you will require some sized curtain stuff, which can be procured for a very few pence per yard, and window width. Red colour suits my fancy, as it looks well, but the taste of others may be different. Take a piece about 2 in. longer than the book, and wide enough to reach round back of same, and lap on each cover about $\frac{3}{4}$ in. Fold each over 1 in., or enough so that it will be exact length of book, and paste them. Then paste inside of book well, and place around back and into sides. Trim the paper covers so that they will fit front and back covers nicely, and paste them on; and if you succeed in saving the title from back of book, if it has one (if not, write one neatly and paste it on same), and then place between two smooth boards, and, with a heavy weight, press it for at least forty-eight hours until it is thoroughly dry, you will have a bound volume of which you need not be ashamed, and it will stand on its end in case as more expensive books.

Sometimes, when I have books in press, I

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cover the edges with dyes, such as are used for colouring cloth ; the neatest colour is red. Dissolve the contents of package in a four-ounce bottle, and you will have enough to last you several years, as it requires but a small quantity to colour the edges of an average-sized book. Put the colouring on with a camel-hair brush.

BOOT AND SHOE MAKING.

BY WILLIAM GREENFIELD.

THE WAY TO FIT THE WELTS—METHOD OF MAKING THREADS.

The way to fit the Welts.—With regard to the welts, you have them already divided into two long strips, and quite wet. I will here explain their further preparation.

You first want what is called a welt mill. This is a tool that does not cost much, is a very handy one, and would be rather hard to make. Both sides of it have graduated steps, which must be equal one with the other on each side. It is a piece of brass or zinc, on a block of wood, having the brass standing up on each side and formed into steps, as shown at A, A (Fig. 1). It is placed upon the knee, and the strap must then pass under your foot, over your knee, and over the mill at B. Then, by heavily pressing down the toe, you will be able to hold the mill firmly on your knee. This is generally done on the left knee. Then you want your quite sharp knife, with a keen, not a rough edge. The welt must be laid on the flat of brass, between the two racks A and A, grain side downwards, with about a couple of inches hanging over the front, as at C. You then pick two of the ratchets, one on each side, and lay the knife in them, the edge being in their deepest corner, holding it there very firmly or you will blunt the knife should the pulling at the welt shake it about.

You pick the ratchets high enough to just admit of the blade of the knife pressing into the welt, in order that you may take off only the smallest possible shaving at a time. This is done by holding the knife, D, with the right hand, and pulling the welt, E, with the left until the shaving is taken off at F to C. Then reverse the welt, take C in the left hand, place the knife in the same position, and take a shaving off the remaining portion of the welt.

For most work, it is well to take the finest possible layer off the grain side, and this is very easily done by repeating the above process, this time with the grain upwards, and with the least possible extra pressure on the knife.

If the welts bought are of the proper substance, this will be all that it is necessary to take off of them ; but if you want them lighter take them down from the flesh side by the same means as above described, going down a rack at a time (one each side) till you get them the required substance.

The welts next need to have an angular piece taken off from the grain side the whole way down. This is about two-thirds of the way through and about $\frac{3}{16}$ in. wide (as A in Fig. 2).

This proceeding will show the welt when turned over—that is, grain side down—with an end (see Fig. 2A) ; and this is the position in which it is held while it is being sewn in for the boot. The arrow indicates where the sewing-awl has to pass through.

If this piece be skived for about 2 in. at B (Fig. 2), the best way to take the remainder off is by digging the point of the knife into the cutting-board, at such an angle that the welt can pass between it, the board, and the first and second joint of the forefinger of the right hand. Then, when the welt is pulled at B, with the left hand, this angular piece will come clear off. The position of the knife, hand, and welt can be seen in the diagram.

Now suppose the boot to be between your knees, toe towards you, you start sewing in the welt at the left corner of the seat, up the waist. If it be the right boot, this side of the waist (the inside) will be the longest. Whichever it is, it must be measured from this point—namely, with the welt—to just the corner of the joint of the sole. Then, marking the joint at this point, in order to know the length it is to be in the waist, you skive the welt down for this distance to about half the substance, taking the skivings off from the grain side. Then the welt is ready for sewing in.

Method of making Threads.—In what I have already written referring to threads (or waxed ends, as they are so often called), I have spoken of "No. 9 Patent" flax. It is well to mention here that this is very nice for stitching, or any light sewing. Hemp cannot well be used for such work, although for very heavy work hemp is best. There are many kinds of hemp, all cheaper than flax. As my readers will constitute many novices, and practised hands know the uses of hemp, I shall deal only with No. 9, it being both the easiest to make the threads with and also the easiest to use after.

You need a small tin box—any box will do, so long as it has a lid and is large enough to take the ball of flax. It must have a small hole in the centre of the lid, and previous to putting the ball into the box you must push out the centre of the ball, in order that you may find the end of the flax. Then put this end through the hole in the lid, and fix the lid on to the box. Do not start a ball of flax or hemp from the outside, or before it is half used up it will get into a tangle and be spoilt.

I will first describe how to make welt threads. The stitching and heel will be made in the same way, but their number of strands (which I will explain later on) will be different. For sewing gents' boots (if they are of a medium substance) you will need about fifteen strands ; if ladies', about twelve ; if stouter work, then eighteen and fifteen ; if lighter, thirteen and ten.

Place the box at your right-hand side whilst sitting. Take the end in the right hand, and run all flax (as you want it) through the thumb and fingers of the left, so that if any irregularity presents itself you can take this out or throw it away. If it be only a small lump it can be picked out with the teeth, holding either side with each

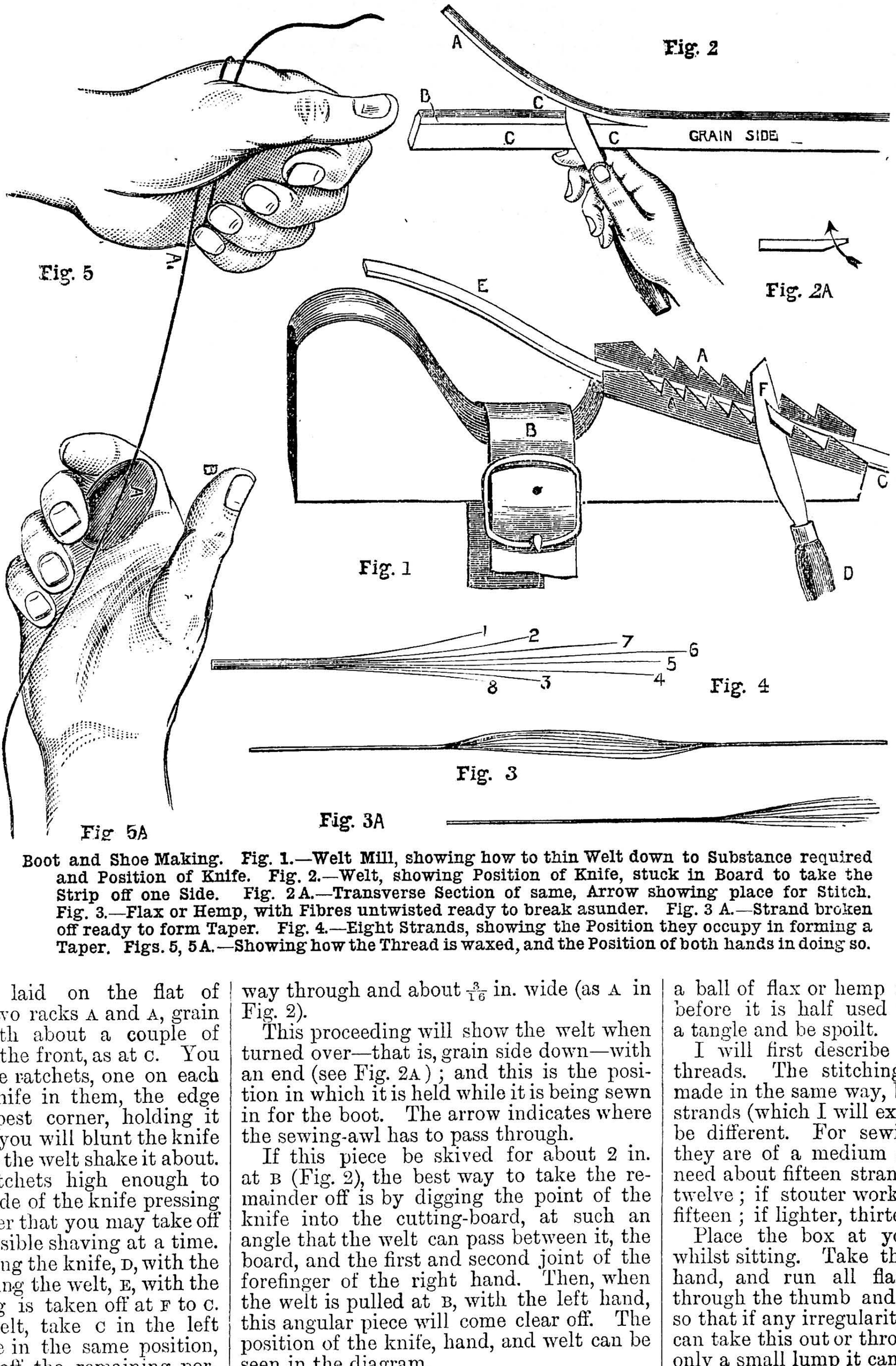

Fig. 2

Fig. 2A

Fig. 5

Fig. 1

Fig. 4

Fig. 3

Fig. 3A

Fig. 5A

Boot and Shoe Making. Fig. 1.—Welt Mill, showing how to thin Welt down to Substance required and Position of Knife. Fig. 2.—Welt, showing Position of Knife, stuck in Board to take the Strip off one Side. Fig. 2A.—Transverse Section of same, Arrow showing place for Stitch. Fig. 3.—Flax or Hemp, with Fibres untwisted ready to break asunder. Fig. 3 A.—Strand broken off ready to form Taper. Fig. 4.—Eight Strands, showing the Position they occupy in forming a Taper. Figs. 5, 5A.—Showing how the Thread is waxed, and the Position of both hands in doing so.

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hand. To start, hold the flax about 6 in. from the end with the left hand; lay it on your thigh about 9 in. from the right knee, and roll the end down to the knee with one long sweep of the right hand. When at the bottom, press it tightly on to the knee, and give the flax a jerk with the left hand. This untwists the fibres. When asunder each end will be quite flossy (see Fig. 3), and when smoothed down will be as shown in Fig. 3A.

The end piece is thrown away, and you measure off the length the thread is required to be. This is generally about three yards long; less is better, as of course every time they are pulled through to set a stitch it helps to wear them away.

The length can be judged by putting out the two arms nearly as far as they will go, and then again about half the distance, or from one hand to the nose. At this place untwist and break as before, this time putting the two ends together, but not exactly level with each other. You now draw the two strands through the left hand, leaving the same on your left side, while you again unravel and break it; and this is repeated each time you add a strand, breaking it off at irregular distances at each end so as to form the two tapers which are to receive the bristles. By looking at 1, 2, 3, 4, 5, 6, 7, and 8 (Fig. 4), you will see how the taper is made; for when you have sufficient strands this will twist into a very fine taper.

A wetted and twisted thread is not so strong as a waxed and twisted one; but a wetted thread is very even to use and easy to wax; therefore, I would advise first the making of one or two in this way. Draw the thread through a little water and then through the thumb and finger, to take the surplus water off; put the centre of the thread over either a hook in the wall or a smooth nail in the window-sill, then stand up, and, with your right foot on a stool or chair, and holding one end or taper of the thread with three fingers of the left hand, leave the thumb and forefinger free, and with these hold the other end, about 8 in. or 9 in. from the point. You put the point on your knee, as you did in casting* off the thread, and twist it in a similar way, holding it while you twist it by the pressure of the right hand upon the knee. Then let go, with the thumb and finger of the left, that the twisting may go quite up the half.

Do not twist too much—about a dozen times ought to be enough—and this you repeat exactly on the other side, being careful each time not to tangle the tapers or twist them so near the end as to twist them off.

This done, put one end in each hand, letting the left go forward and the right backward; then reverse them so that about two feet pass round the nail or hook, and that the centre of the thread may take a little of the twist from each side, and retain it itself. Then put the two ends together and hold them in the left hand very tightly, while briskly rubbing them down with a piece of old white rag. This should make it smooth and rather wiry. A limp thread is not nearly so nice to work, and is caused either by the thread not being wet enough when rubbed down or not twisted enough, or it may be that it was not rubbed till dry.

In taking it off the hook, see that it does not get twisted up and tangled; and when off the hook, just pass it through the thumb and finger to rub out any surplus twist, which it would otherwise hold and give trouble while waxing.

The waxing is not difficult to learn, though rather unpleasant until you get the knack, since it sticks to the hands. I will tell you the way (without holding the wax in a piece of leather) that you are most likely to obviate this.

Now wind the thread once round the left hand, and let one end hang over each side as at Fig. 5, in which A should be about two feet long. Then lay the wax (a piece a little larger than a walnut) on the first and second finger of the right hand, as illustrated at A. Put the left hand well up in front of you and the right just underneath it. Lay the end of the thread on the wax at A; place the thumb, B, over it to keep it steady, and pull the right hand down, letting the thread pass over the wax while it is in that position until you liberate the thread at the taper. This you do two or three times, until it is nicely covered with wax.

Now take it off the hand and wind the part round that has been waxed, and do the next two feet, and so on till the whole is done; but every time you draw the wax down you will find it best to just lightly rub the wax on the knee—not sufficient to take the hardness out of it, but enough to prevent it adhering to the fingers.

For a waxed and twisted thread, you cast it off as shown above. Do not wet it, but wax it instead, and then twist as above explained, and rub it down, not with rag, but with a piece of upper leather. A piece of calf is best for this purpose, as it has oil-dressing in it enough to make it work easy and well over the thread. This you rub, up and down, the length of the half or double thread. Separate the two ends and rub the twist out as with the wetted one; and when you have seen that the tapers are well waxed, you can twist their extreme ends a little more on the knee, and they are ready to receive the bristles. This point I want you to well understand, in order that you may not be troubled every stitch with one or the other bristles coming off.

* The process of putting the strands of hemp or flax together. When the last strand is in it is "casted."

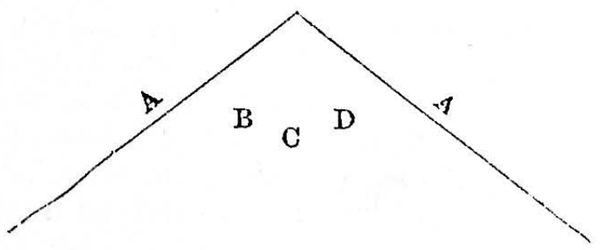
PHOTOGRAPHIC EXPERIMENTS.

CURIOUS, AMUSING, AND INSTRUCTIVE.

BY WALTER E. WOODBURY.

PHOTOGRAPHING A CROWD OF THREE—FROST PICTURES—PHOTOGRAPHING COLOURS CORRECTLY—PICTURES IN ANY COLOUR—A SIMPLE METHOD OF ENLARGING—DISTORTED IMAGES—A PICTURE IN A BOTTLE.

Photographing a Crowd of Three.—For this purpose two large unmounted mirrors, at least 8 ft. high, are required. The best plan is to take your camera to some manufacturer of large mirrors and obtain his permission to make use of two on his own premises for a short time. In a well-lighted room place the two mirrors (A, A) at right angles to each other as shown in the accompanying sketch,



and arrange three persons (B, C, D) in the recess thus formed. The effect is immediately apparent to the eye. The three individuals will be multiplied into a crowd of thousands and thousands, increasing in number as they are apparently distant away. The camera is then brought into position, and a lasting photograph can be made of this peculiar sight.

Frost Pictures.—The beautiful and fantastic designs made by King Frost are too well known during cold winters to need any description. The following is a method by means of which lasting pictures can be made of the beautiful but fleeting designs. On a very cold, frosty day, coat a glass plate with a plain collodion, and when set immerse it in water containing a little salt until all greasiness has disappeared. Then place the plate in a cold place until a frozen image forms itself. When this takes place, fix the plate on to a board covered with black velvet, and make a negative with a slow and thickly coated plate.

Similar crystallic designs can be made at any time by coating a plate with a saturated solution of Epsom salts, and allowing it to dry, which it does in the most beautiful crystalline forms.

Photographing Colours correctly.—The principal defect in modern photography is its inability to reproduce colours with their correct relative value. Thus, for instance, with a light yellow disc on a dark blue ground, the yellow appears to be considerably lighter than the view, but in a photograph it would appear dark on a light ground. In photographing coloured objects the following method of isochromatic photography is greatly to be preferred. Take an ordinary dry-plate, and bathe it for a couple of minutes in a solution of—Liquor ammonia, 1 part; water, 100 parts. Then without washing immerse in—Erythrosine, 1 part; water, 10,000 parts; ammonia, 100 parts.

The isochromatic effect is considerably enhanced if a stripped collodion film containing a small quantity of aurantia dye be interposed between the lens and the object photographed, or a piece covered over the diaphragm slot. Great care must be taken in developing plates of this kind, as they are thus rendered sensitive to the yellow and red rays.

Pictures in any Colour.—These can be produced by what is known as the powder or dusting-on process. The principle of the process is this:—An organic, tacky substance is sensitised with potassium bichromate, and exposed under a reversed positive to the action of light. All these parts acted upon become hard, the stickiness disappearing according to the strength of the light action, while those parts protected by the darker parts of the positive retain their adhesiveness. If a coloured powder be dusted over, it will be understood that it will adhere to the sticky parts only, forming a complete reproduction of the positive printed from. Prepare—Dextrine, ½ oz.; grape sugar, ½ oz.; bichromate of potash, ½ oz.; water, ½ pint.; or, saturated solution bichromate of ammonia, 5 drachms; honey, 3 drachms; albumen, 3 drachms; distilled water, 20 to 30 drachms.

Filter, and coat clean glass plates with this solution, and dry by a gentle heat over a spirit lamp. While still warm, the plate is exposed under a positive for from two to five minutes in sunlight, or from ten to twenty minutes in diffused light. On removing from the printing frame, the plate is laid for a few minutes in the dark in a damp place to absorb a little moisture. The next process is the dusting on. For a black image Siberian graphite is used, spread over

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with a soft flat brush. Any coloured powder can be used giving images in different colours. When fully developed, the excess of powder is dusted off and the film coated with collodion. It is then well washed to remove the bichromate salt. The film can, if desired, be detached and transferred to ivory, wood, or any other support.

A Simple Method of enlarging.—If we have an ordinary gelatine negative, say, of half-plate size, and require to enlarge it to a whole-plate, the simplest plan is to thoroughly wash it and immerse in a solution composed of citric acid, 2 oz.; hydrofluoric acid, 1 oz.; acetic acid (glacial), 1 oz.; glycerine, ½ oz.; water, 20 oz. The action of the hydrofluoric acid will be to detach the film from the glass, while the other acids will cause the film to spread out considerably; the action being even all over, the image is completely enlarged. It is then carefully removed and washed in plenty of clean water, after which it can be transferred to a larger piece of glass. The action is sometimes to weaken the negative in density; it is therefore occasionally necessary to intensify it.

Distorted Images.—Take a portrait negative that is no longer of any use, and immerse it in a weak solution of hydrofluoric acid. The film will leave the glass. It is then washed and returned to the glass support. By stretching the film one way or the other, and allowing it to dry in this position, the most amusing prints can be made.

A Picture in a Bottle.—Get a glass-blower to make an ordinary shaped wine-bottle of very thin and clear class, and clean it well. Next take the white of two eggs and add to it 20 grains of ammonia chloride dissolved in 1 drachm of spirits of wine, and ½ oz. of water. Beat this mixture into a thick froth, and then allow it to stand and settle. Filter through a tuft of cotton-wool, and pour into the specially made bottle. By twisting the bottle round, an even layer of the solution will deposit itself on the sides. Pour off the remaining solution, allow the film in the bottle to dry, and again repeat the operation.

The next operation is to sensitise the film with a solution of nitrate of silver, 40 grains to 1 oz. of water. Pour this in and turn the bottle round for a few minutes, then pour off the superfluous solution and again dry. Hold the neck of the bottle for a few seconds over another bottle containing ammonia, so as to allow the fumes to enter it. Printing is the next operation; this is accomplished by tying a film negative round the bottle, and covering up all the other parts from the light. Print very deeply, keeping the bottle turning round all the time. Toning, fixing, and washing can be done in the ordinary way by filling the bottle up with the different solutions. The effect is very curious, and can be improved by coating the inside of the bottle with white enamel.

REPAIRING SHEET METAL AND OTHER HOUSEHOLD ARTICLES.

BY J. L.

SHEET metal articles and their repairs are legion, and they need a fair amount of knowledge of many trades; they ought, therefore, to be exactly suited to the manipulations of the amateur. It is nevertheless a fact that the houses of the latter individuals are not by any means notable for absence of dilapidation. The drawing-room is often full of pretty and well-executed specimens of turnery and fretwork, but handles are off doors, kettles innocent of lids, and water-cans deposit part of their contents upon floors and tables. Now, such things are easily remediable, but not being exactly pleasant and interesting work, and often being, in addition, rather unclean work, it is very generally shirked, and eventually falls into professional hands.

Of the several operations necessary for household repairs, the use of the soldering iron and manipulation of sheet metal stand prominently forward. It is an easy matter to acquire the necessary skill, and yet easier, maybe, to make a very ill-looking and bungling job of this particular kind of work. The way to perpetrate a bungle is to use a soldering-iron insufficiently heated and badly tinned. I know of no surer method of wasting solder and temper and doing thoroughly bad work.

At best, it must be confessed that a soldering-iron is a top-heavy and awkward tool to use, but no available substitute exists except the blowpipe, and this needs much practice to use efficiently, and for most of the household repairs is not available at all. The usual form of soldering-iron is that illustrated at Fig. 1, and it may be had small and neat for very light jobs, or larger and heavier for general work. The smaller one may be had, with a box of resin and a strip of solder, at 1s., on a card with directions for use. This is useful enough for very light work, but the iron is too small to retain the heat long, though very convenient where gas is available for heating it.

For general work the larger tool becomes a necessity, but the form shown in Fig. 2—which is a "hatchet-shaped" soldering-bit—is, I think, easier to manipulate than the straight one. In all cases the bit is a lump of copper held in an iron socket, except that used by plumbers, which is merely a bulb of iron extending into a handle and untinned, because it needs a red heat, or nearly so, when in use.

The copper should be filed up to a blunt point in Fig. 1, but of triangular section, or to a blunt edge in Fig. 2; or No. 1 may be four-sided and one side bevelled off towards the point, but neither point nor edge need be at all sharp, but only approximating to the figures named.

The tinning may be done in two or three ways. The iron is heated to faint red, screwed in a vice, filed rapidly to clean the scale and brighten it, and it may then be rubbed on a lump of sal-ammoniac, and applied to a bit of solder on a sheet of tin or iron or on a slab of wood, and rubbed about until it takes up a coating of the solder; or take one of the common bricks which has a recess made in it to hold the mortar, and put into it a little resin and a lump of solder, and rub the iron in the hollow. I prefer this to all other methods, as the rough brick keeps cleaning the surface of the iron, which rapidly picks up the tin; and if from any cause the operation is difficult, a few drops of Baker's soldering fluid will almost instantly set matters right. The brick, with the solder that remains, is always ready for use, and, indeed, in actual work I very generally use it to contain the solder that is being used. Speaking here of Baker's soldering fluid, which is widely known and used, it has the fault common to all such solutions of chilling the iron, and if resin or sal-ammoniac is found to answer, either is, for this reason, preferable; but there are many cases in which the fluid preparations are essential to success.

Before we can be in a position to commence repairing metal work—which in general will be sheet metal (tin, brass, copper, and zinc)—a few very inexpensive tools are needed. I do not suggest an outfit of tinman's tools, but appliances that will answer for the repairs commonly needed. First, a boxwood mallet, with one end rounded and the other flat, about 3 in. in diameter—a tool easily procurable or easily made by any turner; secondly, a block of hard wood (boxwood for preference), hollowed out on one side with a hemispherical cavity also about 3 in. in diameter, or larger if the wood will allow it. It will be convenient to have one still larger, for which beech will serve very well. Neither recess need be deep; an inch in perpendicular measure will generally suffice, as the purpose of these blocks is to round up such tin-plate articles as saucepan or kettle lids, of which the curvature is generally slight. The bottom of these blocks may either be level, to stand on the bench—kept steady by a couple of nails driven into the bench, or better, by a carver's screw passing through the bench—or the bottom part may be sawn so as to produce a tenon, to be secured in the leg-vice.

In case the reader may be unacquainted with the carver's screw, it is presented in most catalogues. The tapered end is screwed into the block below, and the tail part passes through a suitable hole in the bench, and is secured by the washer and bow-nut. There is no simple tool of more use in an amateur's workshop.

A blacksmith must be called in to make a hatchet-stake and a beak-iron—the first to enable the workman to turn down the edge of a piece of tin in forming a seam, the other for folding taper tubes such as that of a coffee-pot spout or saucepan handle, or the spout of a lamp-feeder or oil-can. The hatchet-stake, curved horizontally (Fig. 6), will also be required for putting new bottoms to saucepans, water-cans, and such like articles.

I premise the possession of vice, pliers, hammers, and a bench, but there will be needed a few assorted copper rivets, and a punch or two—flat at the end to punch the piece out—for making rivet holes. A pair of tinman's snips, or small shears, will also be needed; and with these alone most of the suggested repairs can be done.

The illustrations are: Figs. 1 and 2, soldering-irons (straight and hatchet); Fig. 3, snips; Fig. 4, a different form, intended for vice-work, and called shears (the snips will suffice for most jobs of mending); Fig. 5, a hatchet-stake; Fig. 6, curved ditto; Fig. 7, mallet; Fig. 8, beak-iron; Figs. 9 and 10, blocks (the second sawn to a tenon to be held in the vice). It will be plain that substitutes may be used for one or two of these (a lathe-rest with long T has been once or twice degraded to become a hatchet- or folding-stake, and I could tell a worse tale even than that); but so inexpensive are the proper tools, and so easily procurable, that it is much wiser to obtain them, and they are much easier to work with. Any good tool-shop (Melhuish, of Fetter Lane, for instance) will supply all the above as cheaply as a village blacksmith could make them.

Let us, however, get to work. The lid of the kitchen kettle has, as usual, come to grief, and Fig. 11 shows all that is left of it—viz., an elliptical bit of iron with a biggish hole in the middle, and slightly cupped. Now, the first consideration is, Can it be mended at all, and is it worth mending? Answer: No. The rim, you observe, has been eaten off by rust, and also a great part

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of what was once the folded edge, and the hole for the handle is terribly enlarged from similar causes. But it is possible to make it serviceable for kitchen use (until a new one is made, at any rate), and the mode of doing so is simple. Lay the cover down on a piece of board half an inch thick or more, and draw a blacklead pencil-line round it. Cut out this with a keyhole or frame saw; or, if you have not such a tool at hand, saw round about it, cutting off the angles till the line is reached. Make another line ⅛ in. inside the first, and trim to this with chisel, rasp, knife, or any available tool; and then see if it will go into the mouth of the kettle. It should enter easily, as it will swell with the steam by-and-bye. Now it remains to attach this under the metal top, to take the place of the rim of tin that used to be there. Probably you will find that you cannot fasten it by nails near the edge, as it would split the wood, so we will use a single screw passed through the hole in the cover; but, as this is much too large, a washer must be cut to overlap the hole, and if the screw is passed through this, and screwed well home, it will at once secure the whole affair. But there is no handle, and the screw—a round-headed brass one by preference—is in the way as regards solder. Bend a strip of tin almost to a circle (Fig. 12), loosen the screw till the ends can be fixed under the washer, and screw down tightly. You have at once a serviceable kettle lid handle, and all complete without a drop of solder, and after a quarter of an hour's work. A touch of Aspinall or black varnish will give the whole a more decent appearance. This, remember, is a mere substitute for a better, or at any rate a more orthodox one, which may now have attention.

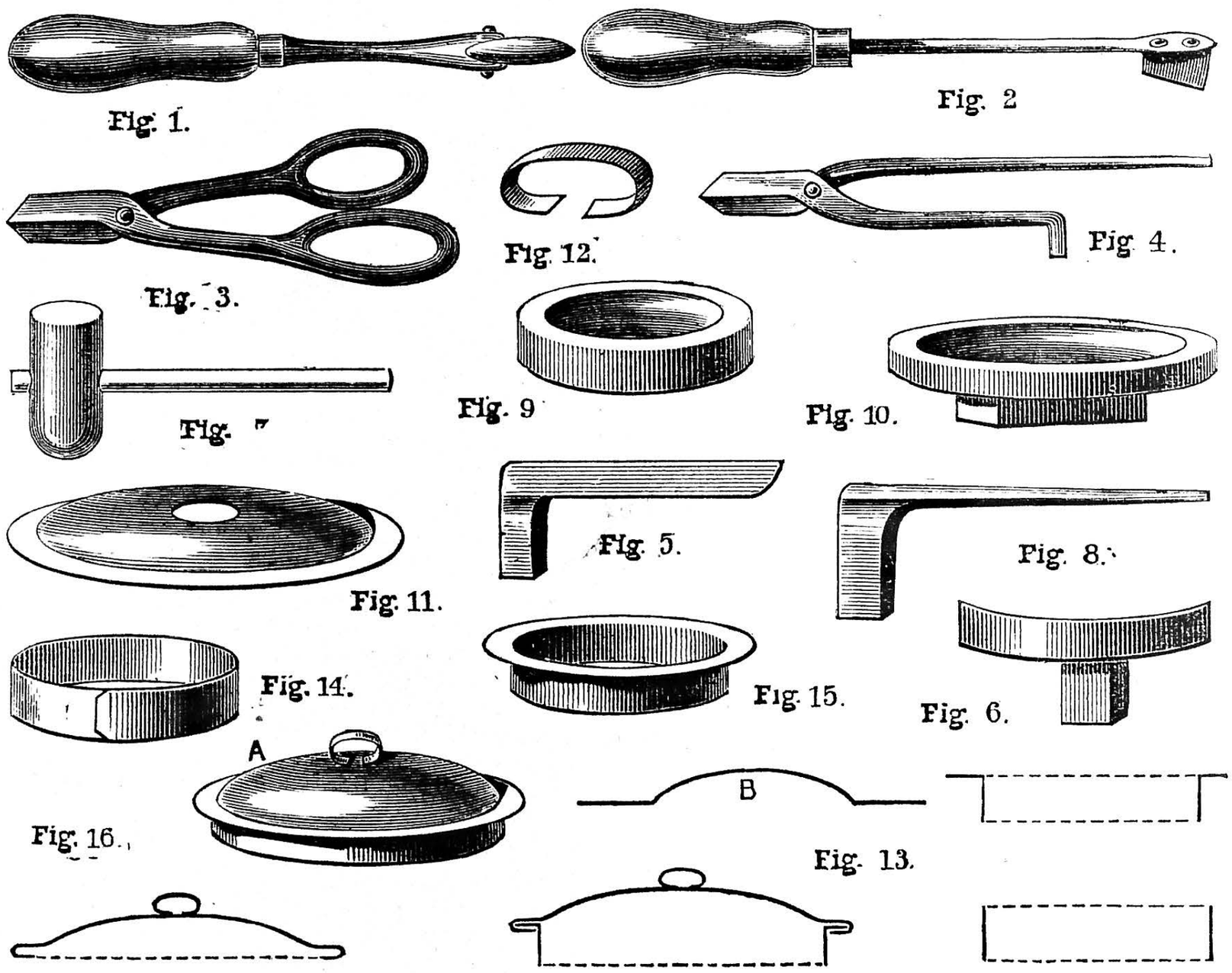
Take a sheet of stoutish tin plate and mark out an ellipse of the required size, using the old cover as a guide if it exists; but if not, a pattern can be easily cut out of cardboard, and transferred to the tin plate by scribing round it. Let it be a little larger than the original, which it will be seen has a folded edge, which will be required also on the new one. It will, moreover, contract it somewhat to make it of a hollow character if this is considered necessary—which, however, as a fact it is not. As a first attempt, the outer edge should certainly be left an inch wide all round, and the cover only hammered up to a small extent about the centre. It will then have the form of Fig. 16, A, seen in section at B. The cover thus partially shaped should be only large enough to overlap the orifice or mouth of the kettle ¼ in., of which overlap ⅛ in. is now to be turned over on the curved hatchet-stake, using the flat side of the mallet or pane of a hammer; but, though bent over, it is not to be beaten down close. This turned seam is, in fact, to hold the rim in place, as well as to give a neater appearance to the cover.

The rounding up or cupping of the central part is not difficult. It is only necessary to lay it on the hollow block and hammer it with the rounded end of the mallet, occasionally giving a few blows also to the edge laid upon a flat surface. It will soon be perceived at what part the blows are necessary to keep the work even, and the process should not be hurried, but carried on gently, so as to avoid risk of puckers along what is to be the flat border. A strip of tin is now to be cut for the rim which enters the kettle, about ⅝ in. in width and just long enough to lap a little when bent to shape. It should be bent round and tried on the kettle itself, and the lap fastened with a touch of solder. The edge has now to be bent all round at right angles to such a width as will allow it to enter the turned-in edge of the cover, which is then to be flattened close down upon it so as to hold it securely.

Fig. 14 is the strip bent and soldered; Fig. 15 the same with its edge turned out square; Fig. 16 the cover put in place, with the rim attached. To make it clearer, outlines or sections of these parts are added. It is not even essential to solder any part of a cover made in this way, as the rim, when once secured in the fold of the top part, cannot possibly get away from it by use, but a little solder is generally run round the fold, to add to the security of the parts. In soldering this or any tin work, let the iron be quite hot, but always below a red heat, which would at once destroy the tinning. Sprinkle a *little* powdered resin along the seam; pick up, by touching it with the heated iron, a bit of solder, which will hang as a drop upon the tinned surface, and transfer it to the seam. Hold the latter so that the tendency of the melted solder will be to run downwards, and it will follow the iron and be led along by it until exhausted, leaving a neat and thin layer and firmly uniting the parts together. A badly tinned soldering-iron will not pick up or lead the metal; and if insufficiently heated it will leave it in lumps, and no real union of the parts will be made. The metal on which the solder is to be spread needs to be itself heated to the temperature of the solder, so as not immediately to chill it; hence the difficulty of soldering thick pieces unless they are first heated over a fire or gas flame so as to melt solder when applied to them.

When mending is needed upon work that has become rusty or dirty, it must be well cleaned and then re-tinned by rubbing the iron upon it with solder and resin, or sal-ammoniac or Baker's fluid, until the surface is fairly coated again; but it is often very difficult to persuade the solder to deposit on such surfaces, and it may be more economical to throw the rusted articles away and replace them altogether by new ones. Baker's fluid will, however, conquer most of such difficulties, or the home-made solution of zinc in hydrochloric acid, which is nearly the same thing.

There has been of late years such an increase in tin goods, where wooden or cardboard boxes used to be the rule, that there is seldom need to buy new sheets for patching and small repairs. If biscuit tins, sardine boxes, and such like are preserved and cut open, the tin can be laid aside in the form of small sheets, circular pieces—which often fall into use just as they are—and clippings of various shapes and sizes, and very soon an ample stock will be secured. It is, however, as well to keep in stock a sheet or two of thicker metal, as some tins are very thin (especially some of the cylindrical ones), and these, although serving for small patches, are of no use for re-bottoming water-cans, saucepans, and articles in constant use. Many suggestions have already been given in WORK for the utilising of old tin—one of the latest being that canisters and milk tins should be cut into scoops, etc., for ladling out small quantities such as sugar, starch, pepper, etc. But beyond doubt the best use of all is that of turning it to account in the repair of metal jobs at home such as those I have indicated. Sheet metal work should interest the hobbyist as well as, say, carpentry; and the true worker must not always expect to find "kid glove" work.



Repairing Sheet Metal Articles. Figs. 1 and 2.—Soldering-Irons. Fig. 3.—Snips. Fig. 4.—Shears. Fig. 5.—Hatchet-Stake. Fig. 6.—Bottom Stake. Fig. 7.—Mallet. Fig. 8.—Beak-Iron. Figs. 9 and 10.—Hollowing-Blocks. Figs. 11 to 16.—Mending and making Covers of Kettle or Saucepan.

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ARE STRIKES ADVANTAGEOUS?—Whatever else the present times may be noted for, there is no denying that the fashion for strikes has grown to unprecedented dimensions. They are necessarily fearful things for the men who engage in them, and still more fearful for the women and children depending on these men. Yet we are sometimes told that these strikes are but the rumblings of approaching struggles of far greater magnitude and involving deeper issues than the question of a few halfpence more or less per hour for labour. The pretext for striking is generally against a reduction or for an increase of wages. Sometimes the men avert the reduction or secure the rise—for a time at least; sometimes, however, they fail, and they get dispersed in their search for employment elsewhere, or else go back to their former employer, with bitterness in their hearts and depressed spirits. The experience is not unknown, we fear, of homes being denuded of whatever articles could be turned into money during the struggle. Beneath all this are many untold tales of tragic intensity. Even the dockers and the 'busmen, though they nominally won, are yet, taken all round, no better off. Has, then, no benefit accrued from these bitter feuds between labour and capital? We believe that no direct benefit, to be at all compared with the suffering entailed, has accrued. Indirectly, however, these strikes have awakened the community to a sense of the hard lot of the workers, and the public mind is resolved that that lot shall be ameliorated. It is no longer possible now for the claims of labour to be neglected, and it is impossible to deny to strikes the credit for bringing things to this pass. This, of course, is a great achievement, but at what cost has it been brought about? Though we are far from the solution of our labour troubles, and though the methods of solution most loudly advocated contain many fallacies in them, nothing can now set back the labour movement. This being so, would it not be well to call a halt, to cease from striking, and to begin discussing? Strikes can do no more than they have done. What is wanted now is a practical scheme for a fair adjustment in our industrial relations, and schemes cannot be evolved while those who should be engaged upon them are fighting. The most important of all questions before the people of this country is that of restoring, preserving, and extending the trade of the country, and of finding a fair and equitable wage for the labour of the people. No legislative process is more pressing than this, and the first care of the new Parliament, or, indeed, of any subsequent Parliament, ought to be this labour and wages question. Upon its trade the prosperity of Britain depends; and where would trade be but for the workers?

FILTRATION OF WATER.—Experiments extending over a number of years, on the Zürich water supply, show that sand filtration affords no absolute protection against pathogenic organisms, for although this statement has been disputed, as also that the rate of filtration affects the bacterial inhabitants of the water, it is now proved beyond doubt that in some cases the water may take up organisms even from fresh sand. The refinements of laboratory research, useful as they are, are scarcely a practical guide in such cases as the filtration of water through sand. Had we microscopes of sufficient power, we should doubtless find animalculæ in the air we breathe and in that we expire. The filter beds used by our large water companies are satisfactory in their action, otherwise the death-rate of London would not maintain its low average. As a rule, fancy filtration is a failure; carbon is the favourite purifier, on account of its capacity for absorbing gases, and, by bringing them into close approximation with oxygen, rendering them innocuous; but on a large scale this cannot be applied economically. In point of fact, those who are rendered nervous by the accounts they read of the universally bacterial state of our surroundings, should boil their water and let it cool in an air-tight vessel before drinking it, unless they will take the trouble to read up a little physiology, and so learn that we have natural defences against these invaders of our health. Ciliary appendages prevent the access of dust to our lungs, and living organisms are destroyed by the digestive action of the salivary glands, liver, and other organs acting in connection with the stomach.

DECAY OF STONE.—Stones of homogeneous texture usually decay by surface erosion, but in some cases the surface becomes indurated, while the interior portions remain soft. In such cases, the exterior shell, so to speak, scales off, leaving the soft core beneath to undergo the same changes. Such stone is quite inapplicable for moulded work—such as banisters and friezes. Climate has also much to do with the decay of stone, and in England it has been noticed that the southern and western parts of our cathedrals yield, while the northern and eastern resist. There is one point that should be universally attended to; it is this—let every stone be laid in the building in a position parallel to its natural bed in the quarry, as nearly as is practicable; we may say, let the run of its strata in the quarry be horizontal in the building.

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DESIGN AND DECORATION OF ALL AGES.

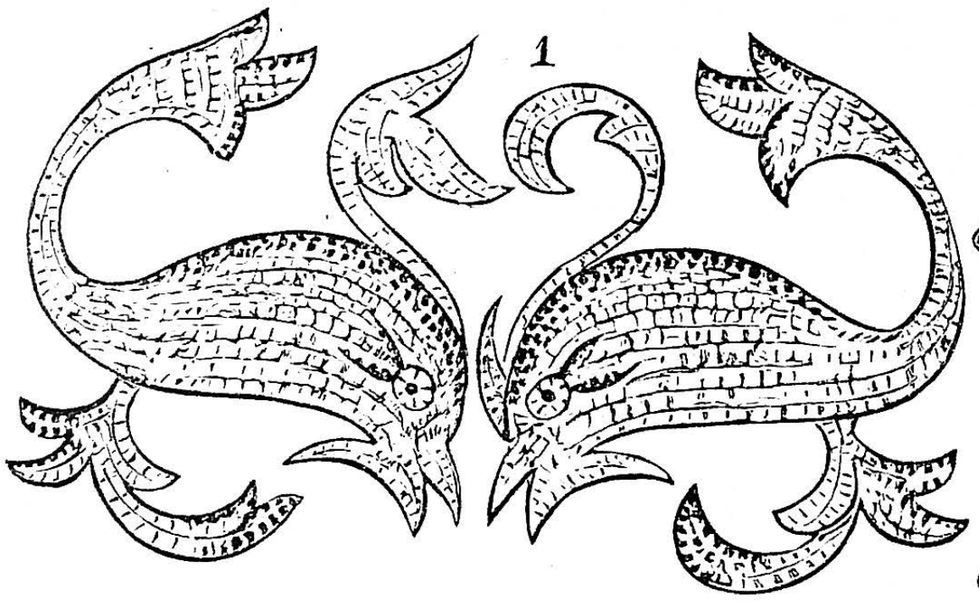
BY M. H. C. L.

Roman.

THE decorative art of Rome is one of the least interesting that can be distinctly classed as a school, for it contains little of originality, and bears the marks of decadence in artistic taste.

The beginnings of Italian art were in Etruria, a large district in the centre of Italy, which flourished when Rome was founded, and perished, as a nation, when the people, who, 385 years before, had separated from the rest, and built a little town on the Palatine Hill, grew strong and conquered the Etruscans B.C. 330. It was the custom of the Romans to spoil the countries which they vanquished of all their art treasures, but in later days their own art seems to have been little affected by these importations. Before they had an art of their own, however, they were susceptible to outside influences, and from the Etruscans and Greeks, to whom as artists the former were closely allied, the Romans drew all their inspiration.

It is considered probable that Etruria was first peopled by the Phœnicians, who are known to have been, in very early days, in the neighbouring island of Elba. Be this as it may, the Etruscans were skilled craftsmen, and have left us many specimens of their art. A large number of bronzes



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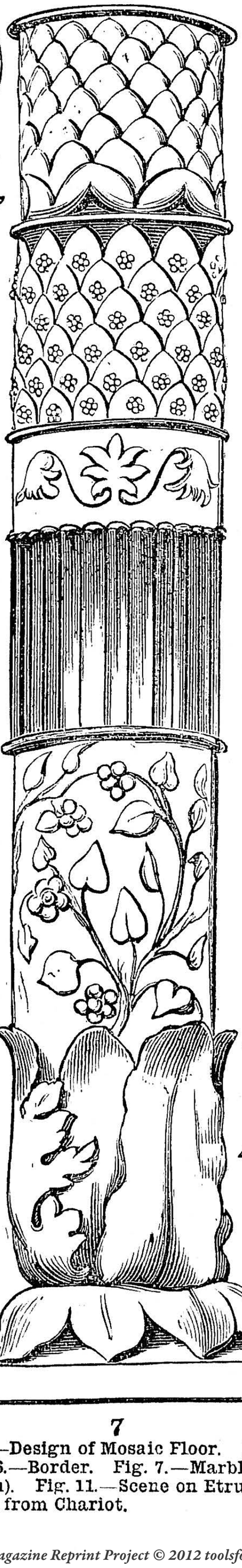

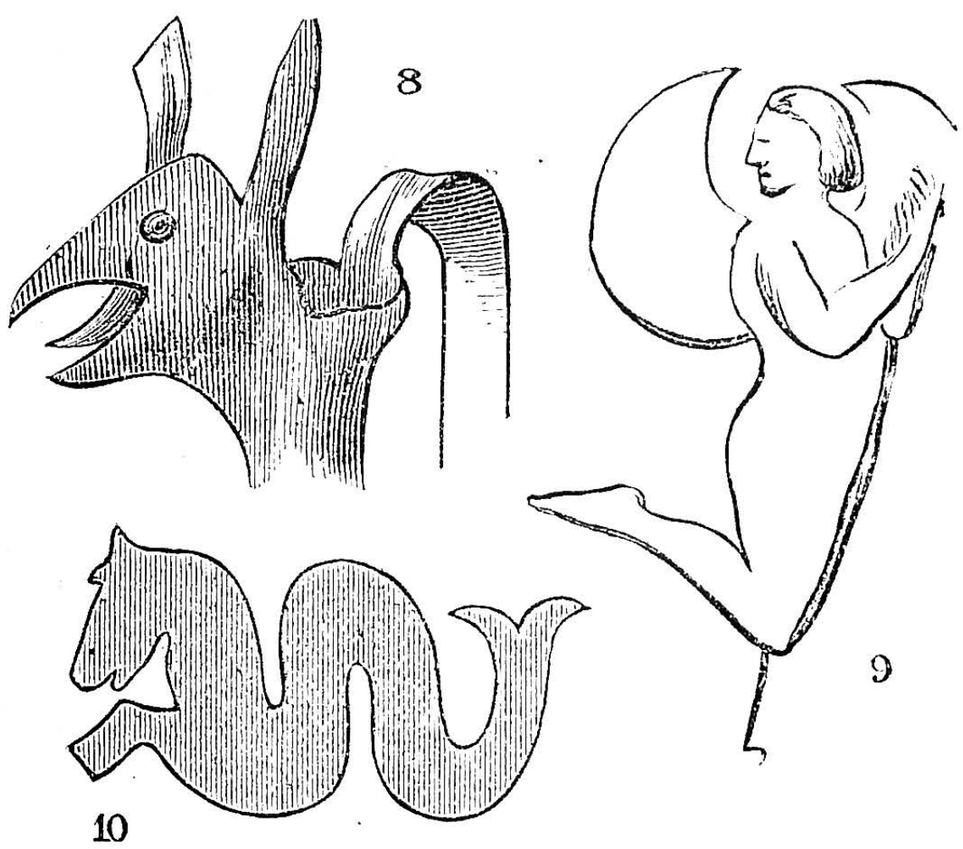

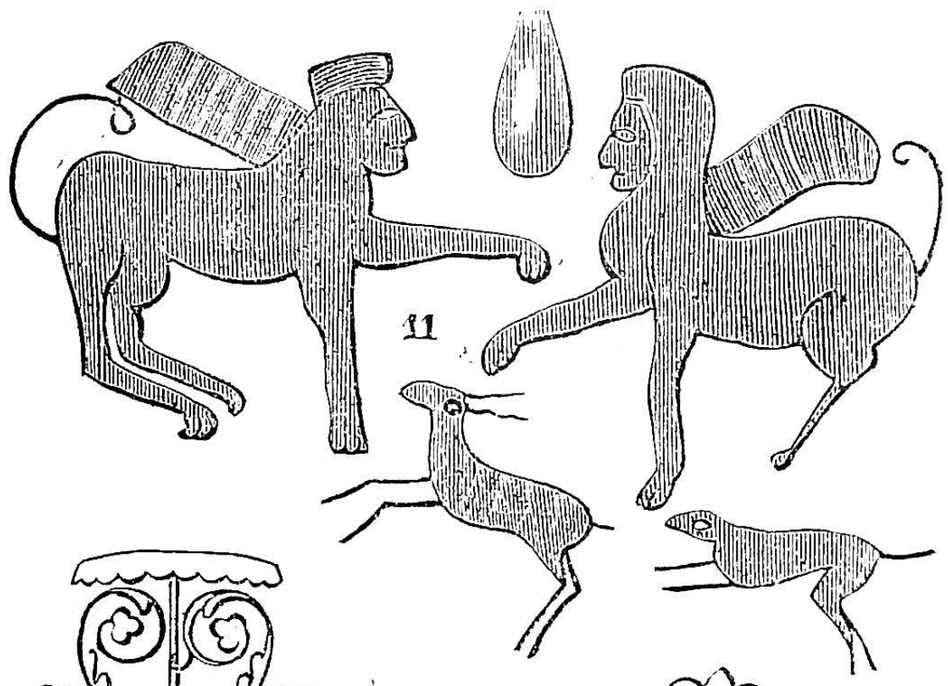

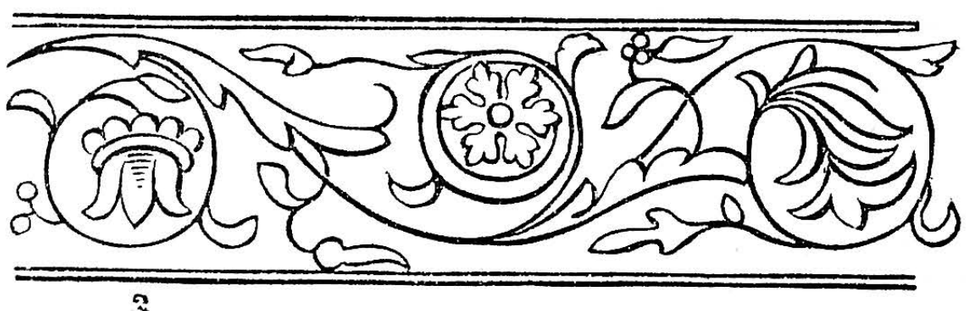

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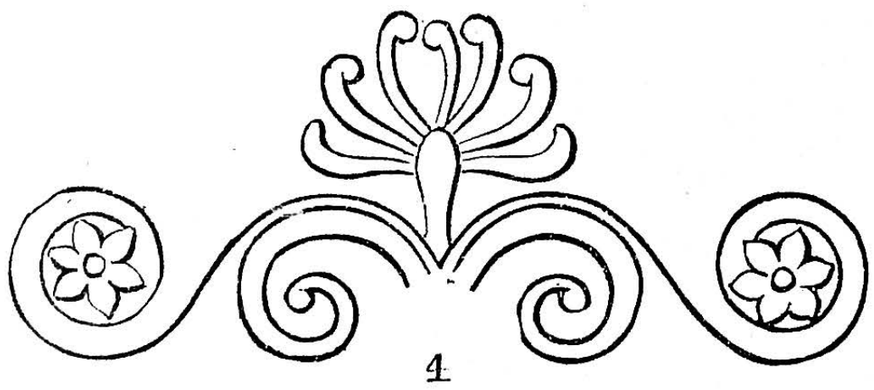

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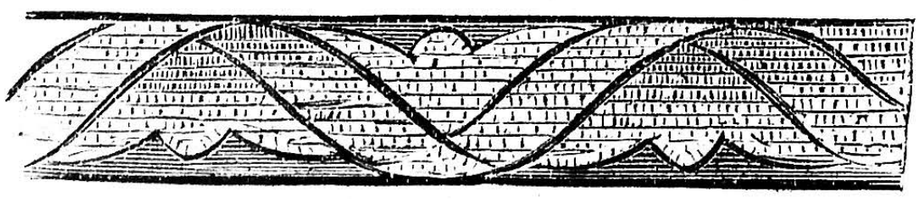

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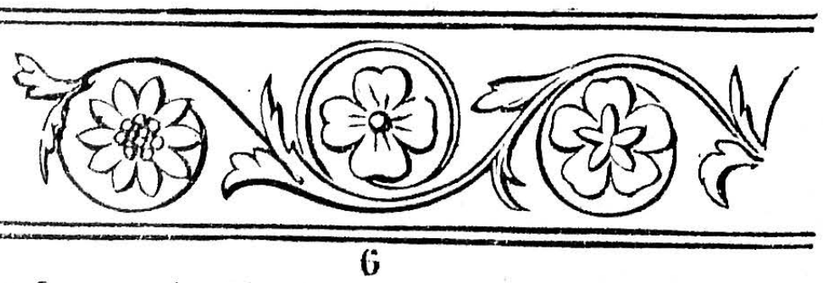

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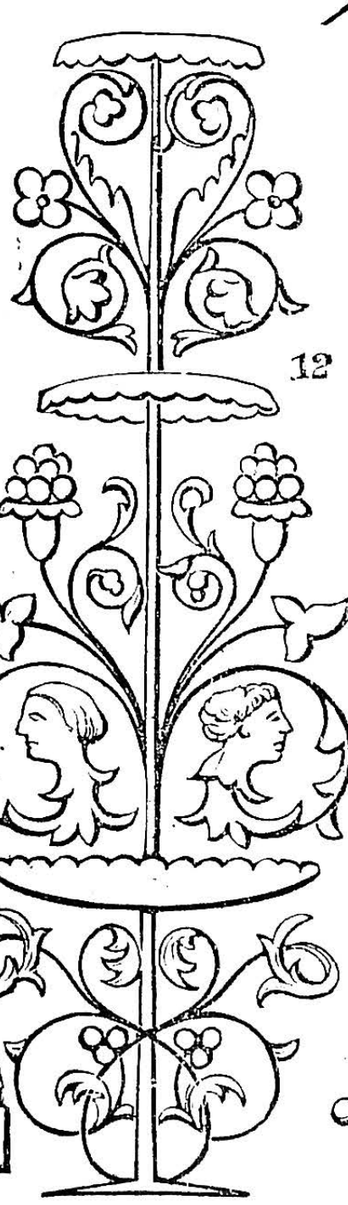

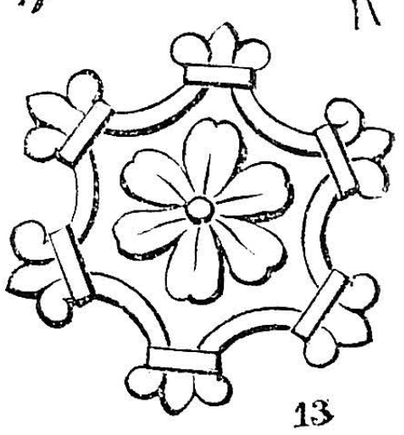

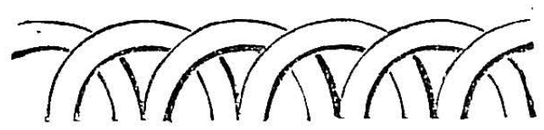

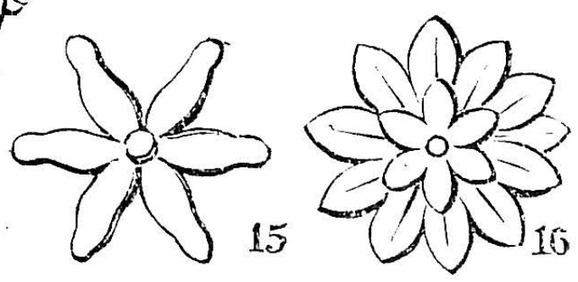

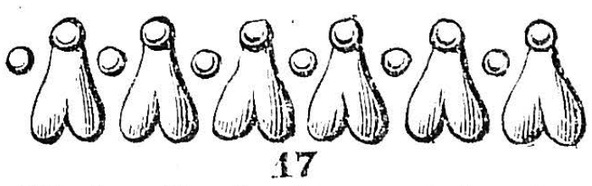

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Roman Ornament. **Fig. 1.—Pair of Dolphins (Mosaic). Fig. 2.—Design of Mosaic Floor. Fig. 3.—Border on Silver Sibula. Fig. 4.—Ornament based on Honeysuckle Design. Fig. 5.—Mosaic Work Border. Fig. 6.—Border. Fig. 7.—Marble Column. Fig. 8.—Mouth of Etruscan Vase. Fig. 9.—Figure in Scene on Etruscan Tomb. Fig. 10.—Sea-Horse (Etruscan). Fig. 11.—Scene on Etruscan Vase. Fig. 12.—Pompeian Wall Decoration. Figs. 13, 14, 15, 16, 17.—Roman Ornaments: from Pillar of Hadrian and from Chariot.**

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and vases have been discovered in their tombs, but it is now believed that most of these vases were either brought directly from Greece or copied from Greek models. There are, however, distinct elements in the Etruscan and the Greek genius : the latter tended to ideal representation, and worked onwards till it produced the human figure in perfect and passionless symmetry. A slight observation of the Etruscan figures, however, as we see them, carved in full relief upon their tombs—a branch of art which must almost certainly have been of native production—shows that their aspiration was different. There is character and human interest in the men and women, all very wide awake, even when in a recumbent position, who have come down to us thus from the dimness of unstoried antiquity. Take, for instance, one of the sepulchral monuments preserved in the British Museum. The man and wife are here shown in the most animated attitudes, with a peculiarly piquant expression and smiles of *espièglerie* on their faces, evidently engaged in lively conversation. There is in the Etruscans that spirit which, as Pater remarks, distinguished mediæval and modern from classic art, the representation of character and the result of human experience upon the face—the picturesque element, in fact—as opposed to the severely beautiful which expresses itself in ideal types. This same tone of the picturesque shows itself in the element of quaintness that characterises their serious objects. Fig. 8 is the top of a vase, on the body of which Fig. 11 is represented.

There is a humorous element in the little deity, Fig. 9, from the tomb mentioned before, which forms part of a group evidently representing some animated scene, as a man who is talking points to the departing goddess. The sea-horse in Fig. 10 is another favourite Etruscan form. Among the archaic bronzes is one which ought to be reproduced by Pears as a companion to his "Dirty Boy"; a woman, much prettier, however, than the old capped nurse, is holding an unwilling boy and rubbing him with a towel. The Assyrian influence is very strongly marked in Etruscan art in its early period. With higher civilisation, it conformed more to the classic Greek type, but it never lost its quaintness, and had thus a special charm and value of its own, so that Etruscan bowls, goblets, and beaten work were sought for throughout the civilised world, even in Athens itself.

It was Etruscan art that gave birth to the art of Rome, but the Romans were a serious people, and though what was the picturesque element in the more artistic Etruscans came out in the Grotesque style, of which the Romans were the inventors, the humorous element is singularly lacking in the women's heads growing out of flowers, and the animals ending in foliated tails, which are known as Grotesque. The origin of the word is curious. A workman, in comparatively modern days, happened in digging to come upon what he took for a grotto, though it proved, on excavation, to be the Baths of Titus : this grotto was decorated with the mixture of animal and vegetable forms (favourite with the Romans), and decoration of this kind was henceforth called Grotesque. When Pompeii was discovered, the walls were found to be decorated with forms like these, and a curious fancy for them seized on modern art. Why, it is hard to guess, unless the charm was that of the strange interest attaching to the place where they were discovered, for they are comic without being amusing, unnatural without being quaint. The loggia of the Vatican is decorated in the Grotesque style. The discovery of Pompeii has had, it is certain, a very marked effect on modern decoration. From the sleep of centuries beneath the lava of Vesuvius was awoke, if we may use the term, a bit of ancient Rome, whose life had been arrested in its full swing. There were the houses just as the people lived in them, the temples, the market places, the very people themselves, they who are beyond awakening, as we see them now in the ghastly little museum inside Pompeii. Most of the treasures found there have been removed to the Museum at Naples, as the wall paintings would soon have perished exposed to the sky, but some of the less perishable decorations have been left in their place; and it is curious—as one wanders through that dreary, dead city, marking the dry ruts where the chariots went in the streets, and trying to repeople the walled spaces where once the complete houses stood—to come across a portion or a bit of wall, brilliant in blue and white mosaic, or many-coloured painting, just as bright and as fresh as when the owners first proudly looked on the new piece of art.

In Pompeii and Herculaneum we have specimens of Roman domestic decoration, and we see that the walls were painted with representations of things as we see them—that is, in perspective of an empiric kind, for the scientific study of perspective did not begin till about the sixteenth century. Besides the decorations, which were, to a great extent, of the Grotesque style, there were actual pictures painted on the walls, little scenes sometimes intended to represent what might be seen on looking through a window. Fig. 12 is a decoration in the Pompeian style. The breaking up of a stalk by stiff horizontal ornaments without any meaning was one of the unlovely inventions of the Romans, with which the Renaissance has made us all familiar. Sometimes birds and animals ran through the foliage; sometimes, as we have seen, the two forms of animal and vegetable life were fused. The colours employed were brilliant rather than harmonious, and the whole system of ornament fantastic, and at best meriting no higher epithet than pleasing.

In the public buildings of the Romans the Greek ideas were followed and improved upon. The Corinthian and Ionic orders were mixed to form a composite order entirely lacking the severe grace of either style.

The one aim of the Romans in their decoration was to produce a rich effect. To richness everything was sacrificed, as is the case in much of the Oriental work, and, sad to say, in a great deal of the work of our own country and our time. Take, for instance, the example in Fig. 7, a marble column of ancient Rome. Here we find the scale pattern in three varieties—the palm-leaf border, a space of fluting, branches of ivy, naturalistically treated, acanthus and broad leaves mixed, and odd little eaves dividing the different varieties of decoration.

The chariot (*biga*) in the Græco-Roman Museum of the Vatican is another instance of mixed decoration. The horses' yoke ends in heads of birds, the bosses of the wheels in lions' heads, and the pole in the head of a ram ; the spokes are decorated with acanthus, the traces with a floral border containing a variety of blossoms. The body of the chariot itself is covered with an elaborate design, highly raised and beautifully modelled, of varied scroll foliage, where from the same branch grow oak leaves and corn, ivy leaves and berries, poppy leaves and seed vessels, and the blossoms of cruciform flowers. Figs. 4, 6, 13, 14, 15, 16, and 17 are ornaments from a biga or chariot, and from the Pillar of Hadrian.

An antique candelabrum, now in the Louvre at Paris, has a similar mixture of ornament, acanthus and oak sprays, broad leaves and oak leaf bordering, all being used to decorate the stem, while this stands on a base consisting of three branches terminating in hoops. In the spaces between the hoops are bas-reliefs of skulls of oxen with ornamented horns. Subjects representing sacrifice are the only instances of art found in the work of the practical and unpoetic Romans. The skulls occur on the Temple at Tivoli. On a tripod from the Villa of Hadrian, also at Tivoli, are three heads of oxen united by the garlands of fruit which hang from their horns, since the victims were crowned for sacrifice. Ribbons flow over the stone surface and confine the garlands, which are in the style copied by Grinling Gibbons in his carvings. The ribbons — a favourite device in Roman ornament—are also, no doubt, a sacrificial symbol. The Romans had no objection to the decorative use of manufactured objects, which we have been taught to think a debased form of art. The base of the Column of Trajan is covered with bas-reliefs of armour ; and masks, such as were worn by the tragic and comic actors, were a very favourite device for the mosaic floors.

These floors were not unusual in private houses, but the largest of them were in the public baths, and those which are left remain as perfect as when laid down. On these mosaics we find scenes from mythology and from ordinary life, birds and dolphins, geometrical designs, frets and guilloches, scroll patterns sometimes simple, sometimes highly elaborate (see Figs. 1, 2, and 5).

The technique of the Romans was excellent, and some of their embossed work is most delicate and beautiful. Fig. 3 is a border from a silver sibula. This kind of border, called by Mr. Leland the wire pattern, now more popular than any other, was evolved by the Romans, who perhaps took the idea from Oriental art. In one respect, as Mr. Stannus points out, the Romans actually improved upon Greek art, and that is in the treatment of the acanthus. The Greek Corinthian column is covered with a number of equal leaves, which, though graceful, give no broad general effect of light and shade. The Romans massed the foliage, and made deep depressions, with corresponding elevations, on a larger plan, and the effect, as seen from below, was bolder and more harmonious. There are two varieties of their acanthus, the olive leaf and the parsley, in which the serrations are rather differently arranged. In fact, the Romans were happy throughout in their treatment of foliage, except when they departed from nature in the meaningless Grotesque style. Their sprays of olive and ivy and laurel are among the pleasantest things on which the eye can rest in Roman ornament.

MODEL BOAT-MAKING FOR BOYS.

BY A CRAFTSMAN.

MAINSTAYS—DEADEYES—SAILS—ENSIGNS—CONCLUSION.

THE mainstays are usually three or four in number. They are fastened to the top of the mast, close to the crosstrees, and on to

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the outside of the hull, a little above the bulwarks. They are made of whipcord, and their lower ends are secured by a sliding arrangement (shown in Fig. 27), or by means of deadeyes. In the sliding arrangement, a piece of wire, of the shape shown in Fig. 28, is tied on to the end of the stay, a hook is threaded on to it, and then the other end is passed through the other hole in the bent piece of wire, and fixed in its place on the mast. When this is done, the arrangement will be in the position shown in Fig. 27. The hook is fixed on to the brass eye fastened outside the hull, and the bent piece of wire is slid up the stay until the whole is stretched quite tight. A stay fixed in this manner is shown in Fig. 29, where A is the stay, B is the piece of bent brass, C the hook, D the eye, and E part of the hull.

The method of fixing the stays by means of deadeyes is more complex. The deadeyes consist of round pieces of wood about ½ in. in diameter or less, according to the size of the boat. A groove is cut round the circumference, and three holes are bored through each. The stay is attached to the deadeye by being passed round it and bound up with fishing string in the manner shown in Fig. 30. A piece of string, B (Fig. 30), about 16 in. long, and having a knot tied at one end, is drawn through a hole in each deadeye until the knot prevents it from going any further. These pieces of string are for attaching the stays to other deadeyes which are fitted on to the outside of the hull. When all the mainstays have been treated in this manner, they are tied up in a bunch, and fixed on to the mainmast in such a position that the deadeyes are about ½ in. above the bulwarks. Their number varies according to the wishes of the constructor, but four are, as a rule, employed. The lower deadeyes must now be fitted on to the hull. A strip of boxwood, of the shape shown in Fig. 31, and having eight holes bored through it in the position shown by the dots, is fixed on to the outside of the hull just above the projecting ledge of the deck. It may be further strengthened, if necessary, by fastening a piece of brass wire from each end of it to a brass eye screwed on to the hull a little lower down. A piece of brass wire is wound round each deadeye, and its two ends are passed through a pair of holes in the strip of wood, and securely fastened underneath it. A cleat is fastened on to the hull at each end of each strip of wood. The strings in the upper deadeyes are then threaded alternately through the holes in the lower and upper deadeyes until all the holes are filled up, when the end is wound round a cleat. When each stay has been secured in this manner, the lower ends of the stays which secure the mast on one side of the hull will have the appearance presented by Fig. 32, where A is the strip of wood (Fig. 31), B, B are the cleats, and C, C are the wires which are attached to strengthen A. The backstays and stays attached to the bowsprit are fastened to the hull in the same manner.

The sails must now be made. The best manner of making them of the right size is to cut paper patterns, carefully measuring the various dimensions, and then to cut them out from the patterns. They must be made of the finest calico, and hemmed all round. Before fitting them in their places, some blocks must be procured, and fixed on to the masts for the halyards to pass over. One of these must be fastened on to each gaff, in the position shown in Fig. 21, and on to the topmast. Two more must be fastened on to the foremast, near the crosstrees, for the halyards belonging to jib and foresail to pass over. An extra block may be fixed on to the end of the gaff for raising or lowering a flag. These blocks can be procured ready made with or without sheaves, or you can make them yourself. One of them is shown in Fig. 33. It consists simply of a piece of wood with a hole bored through it, and surrounded by a piece of wire, one end of which is bent into the form of a hook. A brass eye is screwed into the mast where one of them is to be fastened, and it is hooked on to it.

The sails may now be fixed in their places. For this purpose, you will require several yards of the string used for fishing. Pieces of string are tied on to the gaffs to form the halyards, and are passed over pulleys down to the deck, where they are secured after the gaffs have been hauled up into their right positions. The booms are fitted with sheets, which are tied on to rings which slide along bent wires (M, Fig. 9). The mainsails are tied on to the gaffs and booms, and on to rings which slide up and down the masts. The topsails are hooked on to the end of the gaff and on to the mast at the crosstrees with small hooks made of copper wire. A piece of whipcord is fastened on to the front of the foremast at the crosstrees, and to the deck at the bow, and the foresail is fastened along it by means of rings, so that it will slide up and down. Both the foresail and the jib are hauled up and down by halyards in the same manner that the mainsails are, and are fastened to the deck and bowsprit by short pieces of string tied to brass eyes.

Sometimes halyards are attached to the topmast for the purpose of raising or lowering flags. These latter can be procured at the Model Dockyard. They are fitted on to the halyards in the manner shown in Fig. 34.

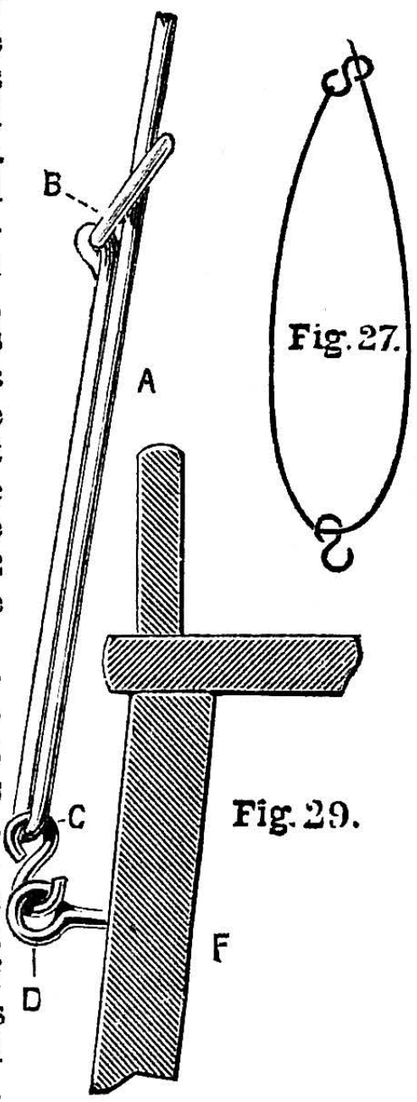

Fig. 29.

Fig. 27.

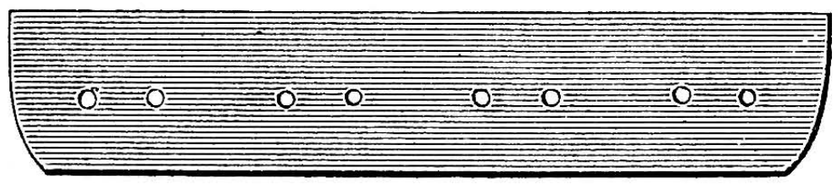
Fig. 31.

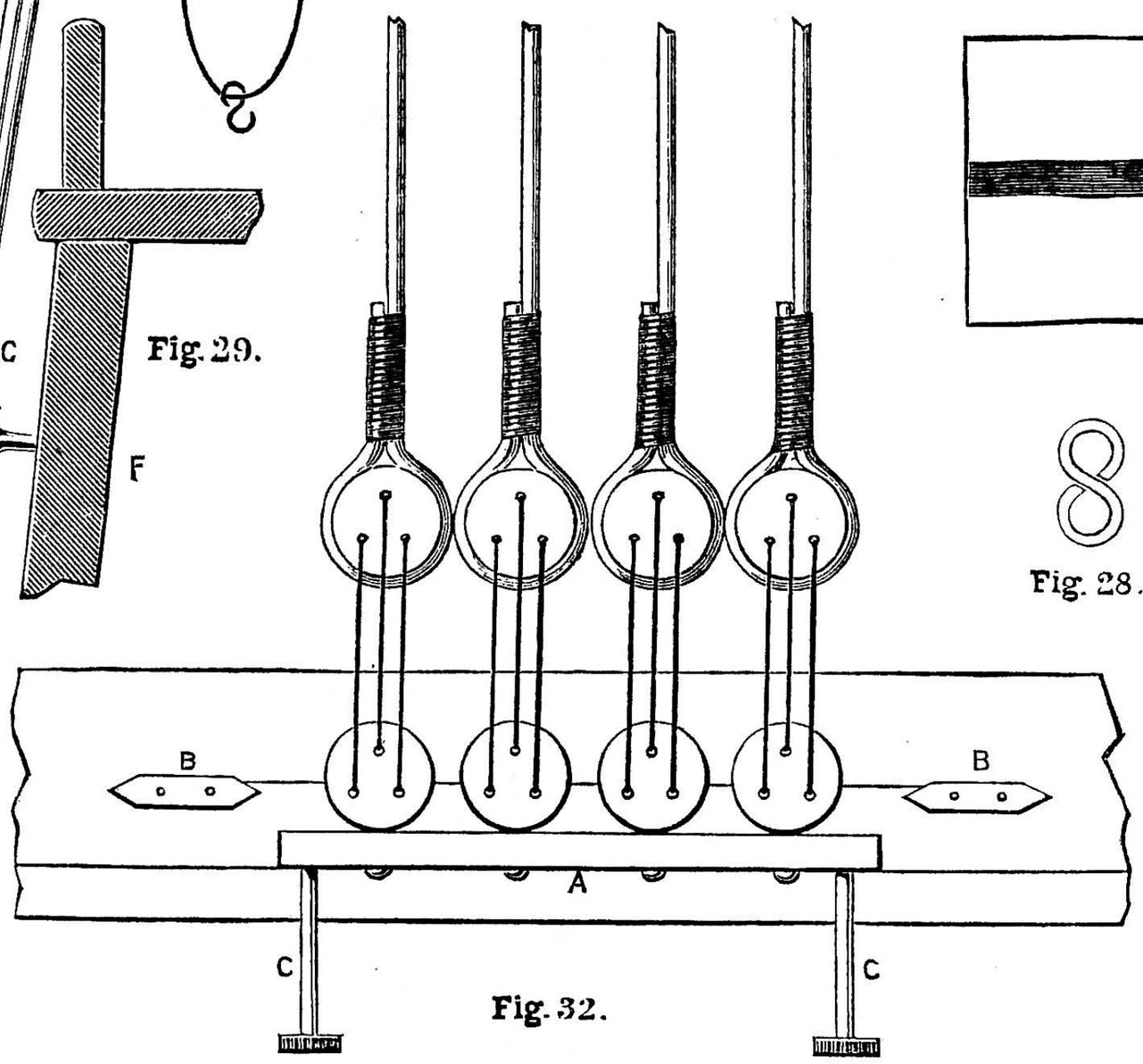

Fig. 32.

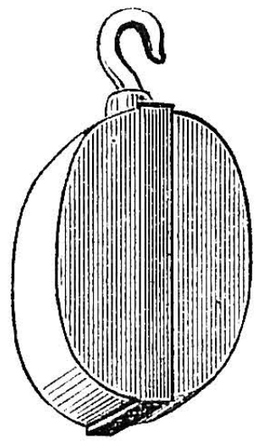
Fig. 33.

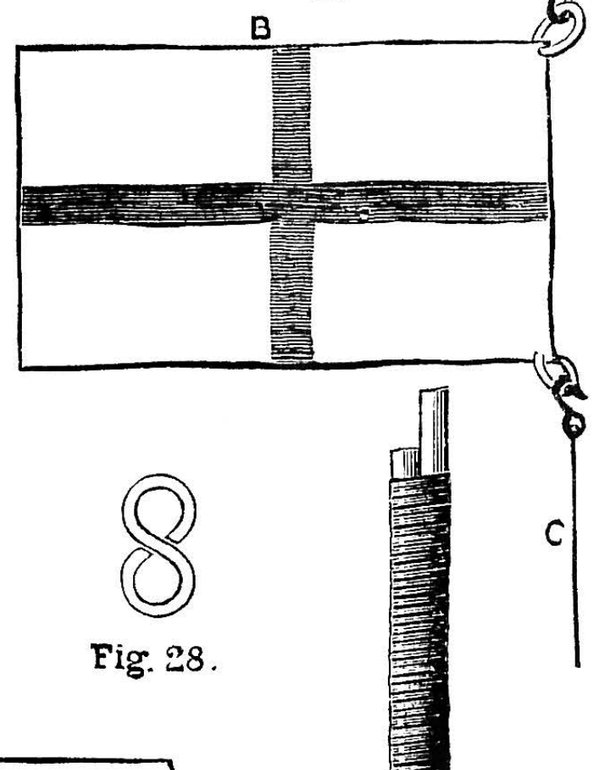

Fig. 28.

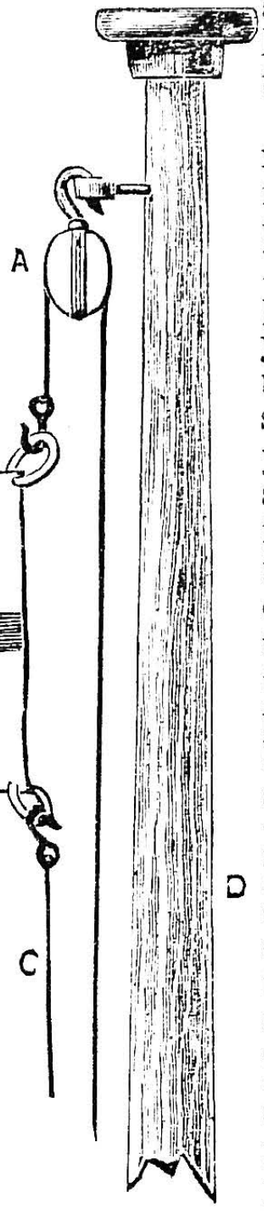

Fig. 34

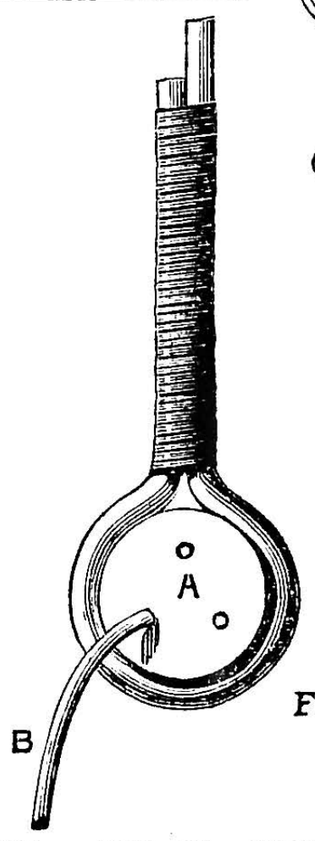

Fig. 30.

Model Boat-Making. Fig. 27.—Stay fitted with Hooks. Fig. 28.—Sliding Hook for Stay. Fig. 29.—Method of fitting Stay on to Hull. Fig. 30.—Deadeye fitted on to Stay—A, Deadeye; B, Piece of String. Fig. 31.—Piece of Wood to which Lower Set of Deadeyes is fixed. Fig. 32.—Set of Stays fitted with Deadeyes—A, Piece of Boxwood (Fig. 31); B, B, Cleats; C, C, Wires with which A is secured. Fig. 33.—View of a Block or Pulley. Fig. 34.—Mode of hoisting Flag up and down from Topmast—A, Pulley; B, Flag; C, Halyard; D, Topmast.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

CUTLERY TRADE.—The cutlery trade shows no improvement, kindred trades suffering in consequence. The strike at Messrs. Rodgers' continues, without prospect of an immediate settlement.

TIMBER TRADE.—There has been another large sale of wood at the North Docks, Liverpool, including 1,458 logs of mahogany, 223 logs of cedar, 547 logs satinwood, 1,249 logs sequoia, 51 tons rosewood, 80 logs oak, 25 logs ash, 454 planks and boards ash, 95 logs whitewood, 3,210 planks and boards whitewood and other.

GLASS BOTTLE TRADE.—The glass bottle industry at Mexborough, which has been steadily increasing during the past few years, is actively employed, the demand being for pickle jars, white wine and aerated water bottles. A new glass works, employing three hundred hands, has just got into working order.

BUILDING TRADE.—Trade in Manchester and Salford is favourable, almost every firm reporting a good supply of work in hand. The lock-out at Bolton continues. Our Liverpool correspondent writes :—Paperhangers are doing a good trade. The wages are 8d. per hour. Plasterers have also a good deal of work on hand ; the wages are also 8d. Altogether, this year has been a good one for all workmen connected with the building trades here.

CYCLE TRADE.—Agents and dealers throughout Scotland are as busy as can be expected at this advanced period of the season—more so, indeed, than in any previous year. The Beeston Humber Company are doing a very good business. They have a large market in the United States, notwithstanding a 45 per cent. tariff paid on each machine, so that a rider of a Beeston Humber in the States has to pay about £50 for his mount.

IRON AND STEEL TRADES.—The Sheffield district forges and tilts are not quite so well employed. Orders for railway material have been placed fairly well, but not to the same extent as in some previous years. Prices of Bessemer finished material are unaltered. Now and again there is a little sign of movement in the hematite market, caused by the fact that the stocks are low. Hematites are quoted delivered in Sheffield at from 58s. to 60s. per ton.

COAL AND COKE TRADES.—The coal trade is fairly active. The stability of the coal market means a great deal to Sheffield, as any sign of weakness prevents quotations for steel or iron being made in advance. Best foundry cokes are now quoted at from 17s. to 18s. per ton at the pits. Steam coal sells well at 9s. to 9s. 6d. ; Barnsley house coal, 9s. 6d. to 11s. 6d. ; silkstones at from 11s. to 12s. : all per ton.

COTTON TRADE.—The Lancashire cotton trade is still depressed, the chief cause being an overwhelming stock of yarn. Our Rochdale correspondent writes : —The cotton, flannel, and engineering trades have not improved in the least, and short time will soon be the rule.

SILVER AND ELECTRO TRADES.—The silver and electro-plated trades have slightly improved, and there is an increased demand for Britannia metal goods for both the home and foreign markets. The sterling silver trade is almost at a standstill.

BOOT AND SHOE TRADE.—In London and all the manufacturing centres trade is quiet. Our Liverpool correspondent writes :—A fair amount of trade is being done in the retail business in the shops in the city, but on the outskirts business is not brisk.

JEWELLERY TRADE.—This is very dull, owing to the elections. The Goldsmiths' Hall has again sent out notices to manufacturers, warning them that no change has been made in the law with reference to hall-marking goods, except that the duty is taken off. The regulations as to "additions" are still in force.

SHIPBUILDING TRADE.—In the shipbuilding trade orders are very few just now, and several of the yards on the Tyne are lessening the number of men they employ. On the Wear there is a fair amount of work, and so far the Marine Engine Works are well off for work ; an occasional order for a steamer is obtained.

CHEMICAL TRADE.—Chemicals are steady, and stocks are kept low.

ENGINEERING TRADE.—Business in most departments in the Manchester district continues to grow gradually less, and unless some material alteration for the better soon occurs, matters will reach a serious crisis. Naturally, the question of reducing wages is now receiving due consideration at the hands of the employers. Shipbuilding, except in the Barrow district, continues in a highly unsatisfactory state. In the Barrow shipyards business continues to be brisk. The iron trade of this district is distinctly improving. In South Lancashire, however, the trade remains in an exceedingly depressed condition, and, although in pig iron prices are firmer, buying is confined to present needs. For steel boiler plates prices have fallen, and £7 10s. per ton has lately been frequently quoted for delivery in the neighbourhood of Manchester. The metal market business is slow, and the tendency is, if anything, downward.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTERS FROM CORRESPONDENTS.

Eggs Encased in Tree Trunk.—A. J. H. (*Brixton*) writes :—"Some sawyers at Whitstable-on-Sea, in the employ of the Whitstable Shipping Company, while cutting up an elm-tree, discovered two swallows' eggs in a hole. It is supposed that a swallow made her nest in the hollow, where they were left, and the tree, in growing, closed up the aperture."

Easily-Made Bracket.—L. G. (*West Dowling*) writes :—"I enclose a rough sketch of an easily-made bracket, which, no doubt, will be appreciated by some of the readers of WORK. The frames can be made of beaded oak picture-frame moulding

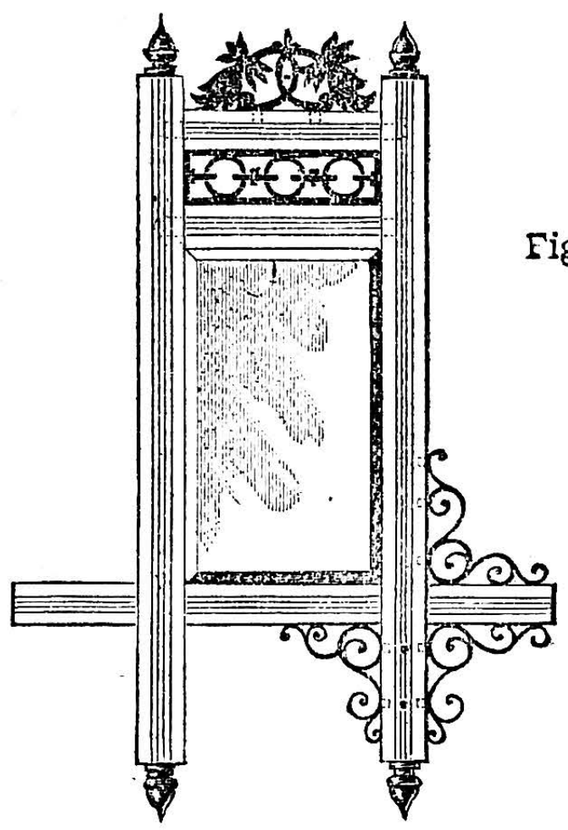

Fig. 1

Fig. 2.

Fig. 3.

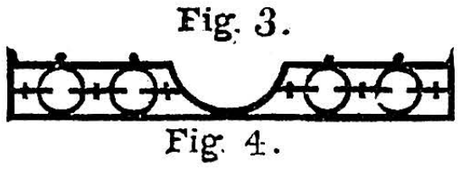

Fig. 4.

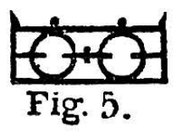

Fig. 5.

Fig. 1.—Bracket. Fig. 2.—Shelf Support. Fig. 3. —Shelf. Figs. 4, 5.—Edging.

(Fig. 1), and panel, corner pieces, shelf, and shelf edging of ¼ in. oak fret-wood, and top ornament and shelf brackets of ⅓ in. oak (former carved in relief) ; and same fitted with bevelled edge mirror, stained walnut colour, and varnished, makes a pretty bracket."

Timber Sizes. — A. J. H. (*Brixton, S.W.*) writes :—"I am glad to see you have noticed the inconvenience that builders and merchants are frequently put to through architects specifying sizes not stocked by any timber merchants (see No. 165). I drew attention to this in my article on 'The Purchasing of Timber' some time ago (see No. 33) ; and I think you would be doing your working readers a good turn by urging writers to specify only such sizes as can be obtained readily at any timber-yard. For the benefit of these and others I give the stock sizes in deals, planks, and battens as follows : 4 × 11, 4 × 9, 3 × 11, 3 × 9, 3 × 8, 3 × 7, 2½ × 7, 2½ × 6½, 2 × 9, 2 × 8, 2 × 7, 2 × 6, 2 × 5, 2 × 4, in yellow deal ; and 3 × 9, 3 × 11, and up in pine."—[Not only builders and merchants are inconvenienced respecting timber, but, judging from the letters constantly coming to hand, amateur and professional hobbyists are in a fix as to woods and prices for sizes for construction purposes. It is a pity merchants do not keep their names and addresses before our readers, with prices for stock sizes of various kinds. Unless we are much mistaken there is business to be done.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

WORK Back Numbers.—W. P. (*Bermondsey*).—You will be pretty sure to find a customer if you advertise in the "Sale and Exchange" column of WORK.—ED.

WORK, Vol. I.—H. H. (*Folkestone*).—WORK, Vol. I., is out of print. You would probably obtain one by advertising in the "Sale and Exchange" column of WORK.

French Polishing.—J. W. (*Darlington*).—The subject of French Polishing has been fully treated in Vol. III. of WORK, in articles and "Shop," far better, in fact, than in any book as yet known to us. There is a book published by Messrs. Wyman, Great Queen Street, London, in their Technical Series, "French Polishing," price 2s. 6d., but this can only be recommended to those who have already some knowledge of polishing—in short, it is a professional's rather than an amateur's work. But, as one who earns his living at polishing, I have pleasure in directing your attention to the articles referred to in WORK by Mr. Denning, and would gladly, did space permit, treat of your difficulty more fully. Briefly, I may say, be sparing in the use of oil : its object is to ease the polish rubber and allow the gums to work easily. The object of "spiriting off" is to remove this oil and increase the lustre. If the polish rubber has been used right and done its duty, this should be a comparatively easy task, but requires care and practice. The chief cause of failure lies in getting the spirit rubber too wet, so softening and tearing up the gums. I have known many meet with success by dispensing with its use, using instead a swab of clean soft rag, fairly damp (not wet) with methylated spirits. For the present, make your polish by dissolving about 6 oz. of best orange shellac in one pint of methylated spirits. As you get more proficient, and wish to get over your work quicker, you may substitute rectified naphtha in lieu of spirits. It is impossible for us to give replies in our next issue.—LIFEBOAT.

Cement Casting.—A. B. (*Thurso*).—For slabs, chimney-pieces, and similar work, the moulds are of wood, made very smooth inside and varnished, while for enrichments, trusses, etc., wax or gelatine moulds are used. The proportion of sand will depend upon the quality of the cement and the nature of the work ; but, generally speaking, for fine work one-fourth of sand will be sufficient, while for slabs one-half or more may be used ; a little experimenting will soon give you the proper proportions. There is nothing used to make the cement set more quickly, as, if good, it will soon set. In casting large articles, they are generally faced with fine cement and the inside filled with a coarser kind, in which more sand is mixed.—M.

Motor.—GUNMAN.—If you use the dry cells described in Vol. IV., No. 163, p. 99, for driving the little model motor (Vol. III., No. 154), you will not meet with much success. If you notice in the article on the motor, it says that it can be driven by two or three double carbon bichromate cells—three are quite enough ; the little dry cell was only given as a rider upon making simple cells. It is the bichromate one that you had better use for the motor ; not that you could *not* drive it with the dry cells (of which you would want at least three in series), but it is not suited for that purpose ; the motor would go for, say, about five or ten minutes, and then stop, owing to the current dying away ; the battery would then want a rest, after such work as that, of some hours before it had recouped itself. Such a cell as described is only suitable when short, sharp currents are wanted, such as ringing bells, etc. Now, the size of a cell is of no moment at all as regards the power—or, to speak strictly, the electro-motive force—that it will produce. Any double carbon bichromate cell with a little less than ⅛ in. between the zinc and carbons will produce an E.M.F. of a little over 2 volts, whether it is made up in a very small jar or a very large one ; it is the amount of electricity that is governed by the size, not the E.M.F. A large cell will perform a certain task longer than a small one : this is why the sizes of the cells were left to your own resources and discretion. Make your cells for the motor to hold about half a pint of solution each ; you will find that they will drive the little motor as long as you will require it. Very large cells become expensive, even if you make them yourself. The sketch you show in your letter is after the carbon holders as sold in the shops to illustrate the arc light ; but I am afraid you could do nothing in that way from the few remarks I could make here. If you do want to try your hand at model electric lighting, look up Mr. Bonney's series of papers in the back numbers of WORK, where you will find the subject simply and ably handled.—J. B.

Directions for Modelling in Clay, Casting in Plaster, etc.—MODELLER.—I know of no cheap handbook which I can recommend, but the subjects in which you desire instruction have been exhaustively treated in WORK, Vol. II. You will find the papers, illustrated by numerous diagrams, in Nos. 53, 56, 60, 64, 68, 71, 74, 77, 83, 88, 93. These will cost you 11d., and form a cheap enough handbook in all conscience, without mentioning the other useful matter contained in the numbers.—M. M.

Newtonian Telescope.—H. W. (*Byfield*) asks for information on the construction of a Newtonian telescope ; also, "Where can I get the speculum and flat?" An endeavour to answer the last question is the sole reason for my not replying earlier. I am afraid that H. W. has grown disheartened at the

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mercury has become very impure, and when at its greatest expansion the upper portion has stuck to the tube, and the other portion has contracted and left the space between. If the former is the cause, then I should carefully heat the lower portion so as to expand the mercury, gently tapping the tube the meanwhile, so as to dislodge the air. Care must be taken not to make the tube very hot, especially at the bend, lest it should break. T. H. W. will find it a somewhat troublesome job, but with care and patience it will yield, I think. On the other hand, if the mercury has stuck through impurity, then the only thing to do is to empty the tube, and either distil the mercury and re-fill, or, what is simpler, press it through a piece of clean chamois skin; this will permit the mercury to pass, but will retain the dross. When the mercury is made pure, the tube must be filled as at the first. Pour a small quantity through the open end, and let it fall as far as it will in the other limb; a cushion of air will prevent it falling to the bottom. Heat must now be applied, which will force bubbles of air past the mercury. When a portion has reached the bottom, then another portion must be introduced in the same way. Bubbles of air must be looked for between the mercury and side of tube—a hand-glass will be necessary; if any are visible, they must be expelled by heat, as before. If now the mercury sticks to the glass, it means that moisture has been introduced into the tube by some means; this too, like the air, must be expelled by heat. If T. H. W. will carefully attend to these directions, I think he will find his instrument answer all right. If, in emptying the tube, particles of impure mercury adhere to the inside of the tube, they must be removed by nitric acid, after which the tube must be carefully washed and dried before introducing the mercury.—O. B.

Gas Meters.—E. F. B. (*Darlington*).—It is absolutely imperative for all gas meters to be stamped with the Government stamp, and any testing must be done by the Government inspector. The general method adopted, if there is anything wrong with the meter, is to adjust the rate of payment by a reference to the account for the corresponding quarter of the past year. If the gas company have broken the Government stamp, and have failed to have another one put on by the proper authorities, they are certainly guilty of fraud, if the facts are as you state. But I should advise you to buy the "Act for Regulating Measures used in Sales of Gas," published by Eyre & Spottiswoode, Queen's Printers, London, price 6d.—E. D.

Camera.—PHOTO.—In WORK, Vol. I., No. 23, you will find full instructions for all required to make a good camera. There are a great number of elementary works published. "Beeton's Modern Photography" or "The A. B. C. of Photography," by the Stereoscopic Company, would probably suit you.

Reckoning Sizes of Pulleys. — HULL.—You forgot to mark with an X the pulley you wished the size of; but I can help you best by explaining how you can yourself find the sizes. Begin with the 200 revolutions of the engine, and suppose you wish the line-shaft (main-shaft) to run 300 revolutions; then if pulley on engine is 12 in., multiply 12 by 200 and divide the result by 300, thus $\frac{12 \times 200}{300} = 8$; therefore the pulley driven by the engine pulley must be 8 in. in diameter. Now you want to run the saw at 900, and its pulley is 6 in, which is driven by the line-shaft running at 300—that is, you want it to run three times as fast; then, since 3 times 6 is 18, you must have an 18 in. pulley on the line-shaft to drive the 6 in. pulley of the saw. Now as to the lathe, why do you want it to make 2,000 revolutions? I should not like that even for the smallest work; 900 or 1,000 are surely quite enough for the fastest speed. Suppose you are content with 900, then have the countershaft run the same rate as the line-shaft strap running on equal wheels, and have the largest step on the countershaft pulley 9 in. and the smallest on the lathe mandrel 3 in.—that will give you 3 to 1 again, and make the 300 revolutions of the countershaft into 900; also the slowest speed will be from 3 in. pulley on countershaft to 9 in. on mandrel, or 1 to 3, which will make your slowest speed for turning 100 revolutions.—F. A. M.

Chain Gear Cycles.—DOUBLE GEAR.—There are several change gears for safeties already in use. Of course, I am not prepared to say whether any of them are exactly like your correspondent's idea. The latest two-speed gear is that of the Cycle Gear Co., Coventry. I have not yet seen it, so cannot describe it. To get reliable guidance in the matter, write to Mr. R. E. Phillips, Consulting Engineer and Patent Agent, Royal Court Chambers, 70 and 72, Chancery Lane, W.C. He will supply copies of patents relating to double-chain gears at a very small cost.—A. S. P.

French Polishing and Stains—Book.—GUMPOT.—Why do you want to buy books when you have all you may require at your fingers' ends in the pages of WORK? Vol. III. contains a series of articles on the subject, and the replies in "Shop" deal with points and difficulties such as you and amateurs generally may meet with, and which it would be impossible to foresee and embody in any book on the subject. There is no book on the subject of staining to our knowledge; there is generally a chapter devoted to the subject in works on French polishing. It shall, with the Editor's permission, receive due attention in time in the pages of WORK. Meantime, fall back on H. C. Stephens's stains, which can be bought ready made either in liquid or powder—they are used in many cabinet shops in preference to making their own by reason of their uniformity of colour and depth of tone—that is, if you can find none in "Shop" to suit.—LIFEBOAT.

Incubator.—W. H. S. B. (*Derby*).—Order from your bookseller Nos. 143, 150, and 151 of WORK, or send 4½d. in stamps to publishers for same, and you will find full instructions on this subject.—LEGHORN.

Tool for Boring Pulleys, etc.—J. A. (*Middleton*).—Fig. 1 is a sketch of an ordinary chucking-drill as used for boring cast iron; it usually has no point, since it is used for *enlarging* holes which have been bored or cored. Fig 2 shows the process—B is the pulley boss, A the drill, C the back-centre, R the boring-rest, which both steadies and prevents

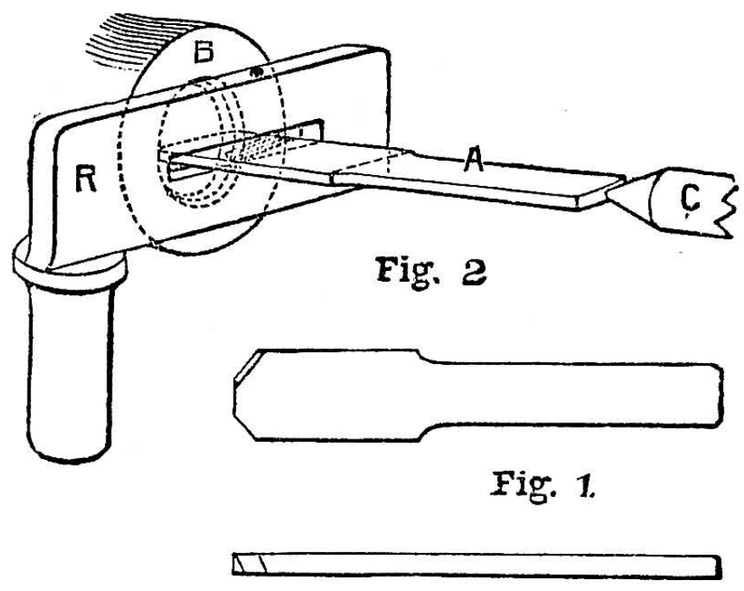

Fig. 2

Fig. 1.

Fig. 1.—Chucking-Drill. Fig. 2.—Tool in Process of Boring.

the drill from turning. The hole is started with a slide-rest tool so as to get a true entry, and in Fig. 2 the drill is supposed to be just beginning its work. I don't know of an expanding mandrel not patented, but you should have a set of solid mandrels rising by eighths. It is best to have them of hardened steel and ground true.—F. A. M.

Viola.—F. H. (*West Ham*).—Before attempting to make a "viola," which is a "tenor" violin, why not try your hand at making an ordinary violin? You have full directions, patterns, and dimensions given in the back numbers of WORK. The instructions for making a viola would, to a great extent, be a repetition of those you possess, the outline and the various dimensions only being different; the method of making both instruments is exactly the same. To give a full outline and patterns would occupy too much space for "Shop." Here are the measurements you ask for: Length of back (exclusive of "tab" or "button"), 16¼ in.; width of upper bouts, 7¼ in.; width of lower bouts, 9⅝ in.; width of waist, 5⅛ in.; depth of ribs, 1½ in. at the top, deepening to 1 9/16 in. at the bottom; length of bass bar, 12 in.—B.

Kitchen Dresser.—J. G. (*Edinburgh*).—You will find most of your questions answered in Vol. III., p. 530, but perhaps this arrangement (see sketch)

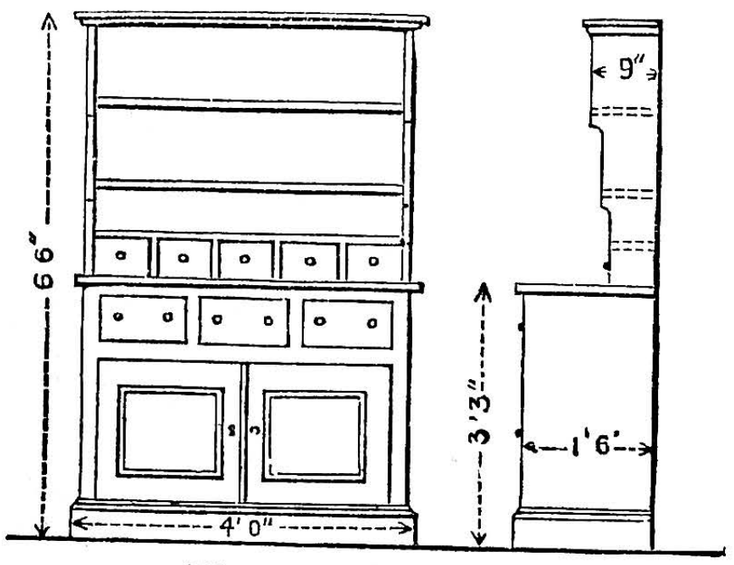

Fig. 1 Fig. 2.

Kitchen Dresser. Fig. 1.—Elevation. Fig. 2.—Section.

would suit you better, and the sizes marked thereon will be more convenient than those given in the design referred to above.—F. J.

Greenhouses.—H. F. (*New Cross*).—Several designs have been given in the present volume (IV.) of WORK. Consult previous indexes and "Shop."

Poker Work Machine.—M. T. (*No Address*).—I am sorry to say that you have evidently made a mistake with regard to the machine for poker work at that low price. The cheapest apparatus I have ever come across was one of German make, the price of which was 10s. 6d. I am sure it could be obtained of Derry & Tims, Kensington High Street, W.; or try one of Messrs. Hallam & Scott's, Manchester. A machine at the price you mention could not be made strong enough for the purpose. It is necessary to use the best materials, otherwise there might be an explosion of the benzoline, and the work would turn out to be rather dangerous.—J. N.

Incubator.—F. C. B. (*Deptford*).—Your ether is too strong, or else you are using too much of it. Half an inch above the mercury is ample. The proportion you are using is correct, but possibly your drops are not all the same size. If the ether forces past the mercury it is evidently too strong, and must be weakened. You will then find the mercury resume its normal position.—LEGHORN.

Electro-Silver-Plating.—F. C. (*Plymouth*).—(1) Your silver-plating solution is not the best obtainable. When silver is precipitated from its nitrate solution by adding a solution of carbonate of potash, and this precipitate is dissolved in cyanide of potassium, there is an excess of potash in solution, which does no good then, and eventually does harm. The silver should be thrown down as silver cyanide by adding a solution of cyanide of potassium to the nitrate solution; then dissolve this in a solution of potassium cyanide to form the plating bath. (2) The Daniell battery with 6 in. porous cells is all right. Your failure in successfully plating the cruet-stand is due to more than one cause. First cause: The frame, having lead mounts, or so-called "silver edges," is composed of two kinds of metal, which form a galvanic pair in the solution, and the lead dissolves under the influence of the current. Consequently, it will not receive an adherent coat of silver. Second cause: The silver remaining on the unworn parts increased this local action in the plating solution. Third cause: The anode surface was just one-fourth too small, and the quantity of solution also too small for the job. The solution was not strong enough at first, and was weakened by trying to plate such a large article. (3) The lead mounts, together with the whole frame, *must* have all the old silver stripped off in an acid pickle. The whole frame *must* then be coppered in an *alkaline* coppering solution before it is placed in the plating solution. A sulphate of copper, or any other acid, solution will not do. The process is too long to be detailed here in "Shop," but is fully described in my "Electro-platers' Handbook." (4) Some information on silvering jewellery has been given in WORK, Vol. III., p. 118. From this you may learn something. My "Electro-platers' Handbook" is a book of moderate price (the price is 3s.), and you can get it by ordering it of any bookseller. I do not know of any other at such a low price.—G. E. B.

Scene Painting.—R. R. S. (*London, N.W.*).—You may, if proficient, obtain employment by reading the "Wanted" columns of the *Era* theatrical paper, which appears every Saturday, and generally has one or more advertisements for assistant scenic artist. Go for a small salary first, to get a start, which is *most difficult;* but get it, and if you have any talent at all, you will soon rise. If I knew your abilities, I could tell what chance you had of success. One piece of advice I would give. Do not go too far away from home, as money is not always sure. In theatrical terms, "the ghost may not walk," and you would be in difficulties. You, having no references, must state that you have been very successful as an amateur, and accept any terms to get your first start. I wish you every success.—W. C.

Organ-Building Book.—W. W. (*Camberwell*).—Apply to Messrs. Crosby Lockwood & Co., Stationers' Hall Court, Ludgate Hill, London, E.C.

Brazing Tube.—T. W. S. (*Deptford*).—Presuming that you have a forge, or the use of one, to braze your stamping to a tube, proceed as follows: Carefully file out and clean the inside of the tube where the stamping is to fit; then fit your stamping to it. Let it fit very tightly. As to pinning it, I do not consider it necessary; if it is brazed well, the pin is a superfluity, and if it is brazed badly, the pin will not be of much use. Make up a clear fire of coke (broken small), and wind some small brass wire round and round the part to be brazed. Have by you some powdered borax and some spelter in some such receptacle as the lid of an old canister. Sprinkle a little borax over the spelter, and moisten it with water. Flatten out a piece of ¼ in. rod at one end, and turn an eye at the other: this will do for putting on the spelter. Place the work on the fire when quite clear, and warm it a little. Have plenty of room, so that you can turn the affair (should it be a backbone). Place some of the mixed spelter and borax on the work, and commence to blow; when it gets to a dull red, throw a little borax on: this will help the metal to flow. Keep up a gentle blowing till you see the spelter run; then turn the work over carefully, and put a little more spelter on. Blow this until it has run down (assist it with borax), and rub off the superfluous metal; cease blowing, and, after a few seconds, lift it carefully off to examine, and to see if the spelter has gone all round; if not, you must go over it again, giving special attention to that part. I might say that, if you think it difficult to turn the work, you can work the spelter under it by means of the rod previously mentioned, which you must keep dipped in cold water, or it will pull the spelter off.—R. A.

Motors.—METAL.—Articles on Electric Motors appeared in WORK, Nos. 109 and 154.

Knotting, Splicing, and Working Cordage.—T. H. (*Huddersfield*).—Articles appeared in WORK, Nos. 105, 109, 113, 117, 120, 124, 127, 131, 139, 143, 147, and 150.

Scene Painting, etc.—E. C. (*Kirkdale*).—Articles on Scene Painting appeared in WORK, Nos. 92, 95, 97, 101, and 103; on Graining, in Nos. 55, 58, 62, 65, 69, 72, 76, 79, 85, 89, 93, 95, 98, 100, and 103; on Stage Carpentry, in Nos. 140, 144, 149, and 154.

Old Violin.—W. L. (*Hitchin*).—Bull, of Windmill Street, London, does not hold high rank amongst the English makers; but one frequently

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result may not be a true spiral, and the correct way, I should say, would be a screw-cutting lathe, as it is really a screw that is wanted. I have before now utilised an ordinary wood screw, filing it to size and finishing by hand, for sundry jobs.—A. B. C.

Weldless Steel Tubes.—L. E. (*London, W.*).—The proper way to bend steel tubes is to put them through rolls as in a rolling-mill, the rolls having semicircular grooves in each to coincide with and of the size to admit the tube. As your correspondent may not have a rolling-mill handy, he may get through the operation as they do in small cycle-repairing shops—namely: if the tube is to have but a slight bend, it is done by heating to red all the part equally to be bent, and gripping the cold end gently in the vice; if the tube is long, it will serve as its own lever; if short, a bar is thrust into the end and used as a lever, when the requisite amount of bend may be given. If the bend is a quick one, especially with tubes of one inch and upwards, the part to be bent is filled with dry sand, rammed hard, and plugged at each end with paper to keep the sand in place; heat and bend as before. It is to be remembered that the part that is hottest will bend first; therefore, the whole of the part to be bent must be heated *equally*.—A. S. P.

Shop.—ANXIOUS.—Yours is rather a difficult problem. You say there is a 9 in. brick partition between the two houses, and no communication whatever, but your next-door neighbour complains of you knocking. You might try fixing two or three thicknesses of carpet felt (not paper) over the whole of the wall. This, of course, could be covered with match-boarding, or battened and papered if found effective, but by itself I am afraid it would not be so. Where the trouble is is where you knock. In your business, as far as I have been able to notice, the knocking takes place in one spot—say, a yard square. Now, what I should advise you to do is to thoroughly isolate that spot from the rest of the building. This is not a very great undertaking, especially as I understand from your letter you are the owner of the property. First cut a hole in the floor as large as the surface you require to knock on, take up the floor boards, cut up the parts of the joists exposed, properly supporting the ends of the joists cut and left in. Then dig out the ground (I assume your shop is on the ground floor) to the depth of 1 ft. 6 in. below the floor line. Now construct a rough wooden box 2 in. smaller than your hole all round; thoroughly ram the bottom of the hole and put in the box, wedging it temporarily away from the existing joists all round; the box should only have sides, no bottom. Next fill in the box with Portland cement concrete, made with two parts of clean-washed ballast to one of cement. Now bed in some pieces of 4½ in. × 3 in. joists, cut so that the bottom part is larger than the top, to prevent it drawing out of the concrete, keeping the outside joists at least six inches from the outside of your concrete bed, and bring the whole up to the same level as the existing floor joists. You now have a solid block quite independent from the surrounding floor, and when the cement is thoroughly set—which will not be for about six days, no matter how hard it may appear on the top surface—cover the space with two thicknesses of carpet felt, and re-nail your floor boards down, cutting them so that they do not touch the old floor by about ⅜ of an inch all round. The space left all round the "knocking-block" should be covered with a piece of soft leather nailed all round on the old floor, and just butting up to the edge of the boards of the block, which will, if done as directed above, stand above the old floor level by about ¼ of an inch.—E. D.

Nickel Plating.—NEW READER.—Articles appeared in WORK, Nos. 15 and 48.

Author's Correcting Signs.—HITHER GREEN.—Messrs. Pears gave a sheet away some years ago as advertisement. Get it, or apply to Messrs. Pitman, Paternoster Row. The matter is treated in one of their shorthand works.

Old Violin.—C. W. (*Lumbutts*).—From your description of your violin, I cannot gather anything which would lead me to give an idea of the maker's name. Many of the *early English* fiddles have a very thick neck, and frequently require to be "grafted"—that is, to have a new handle spliced in—before they are fit for use. If you wish to know more about your fiddle, you had better consult someone competent to give an opinion.—B.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

G. D. C. Monogram.—G. D. C. (*Brixton*) writes:—"Will some reader kindly give me, through your valuable paper, a design for the monogram G. D. C., of a similar design to the one given to H. E. B. in No. 165?"

Racing Cutter.—J. B. (*Glasgow*) writes:—"Would any reader oblige me with instructions how to make a racing cutter yacht, to be 3 ft. 6 in. long?"

Asphalte Paths.—W. R. (*St. Albans*) writes:—"Will any reader of WORK kindly inform me if garden paths can be made of ashes, pitch, and tar; and, if so, what is the best method of doing it, or any other cheap method of making asphalte paths?"

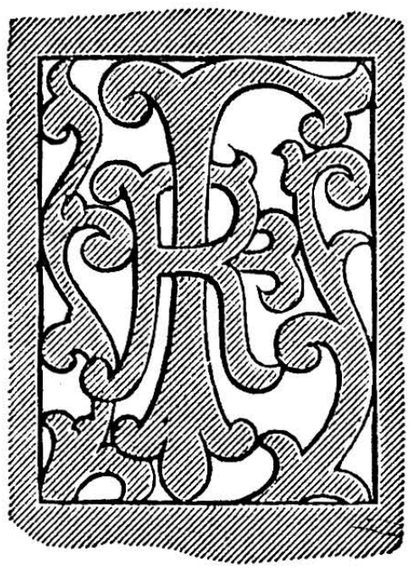
Quarter Horse-Power Engine—Heliostat.—G. W. S. (*Church, near Hyde*) would be glad to make the acquaintance of A. P. S. (*Hyde*), whose letter to the Editor respecting the ¼ h.-p. engine was answered in No. 149, p. 706. Having completed the ¼ h.-p. engine, G. W. S. would be much obliged to F. A. M. for some information about a suitable boiler as to size, where obtainable, etc. G. W. S. would also be glad if some reader would explain how a heliostat is to be constructed.

Mail-Cart Design.—POOR FATHER writes:—"Will some kind reader of WORK give me a design for an easily constructed mail-cart?"

Hanging Lamp.—W. E. W. (*Wimbledon*) writes:—"I have a duplex hanging lamp, purporting to be of wrought iron and copper. I find the latter is not of that metal, but of brass plated (?) with copper, which has in places (especially on the reservoir) been entirely removed by the action of the paraffin. I shall be glad to know: (1) Is this the usual mode of construction, or is it adopted as a way to make a cheap article in imitation of the better sort? (2) Is it within the scope of an amateur to re-copper the parts; and if so, what is the process? (3) Would it be better to burnish and lacquer the brass; and if so, what would be the best way to remove the copper deposit? (4) Where could I get the articles re-coppered in London?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

R. F. for Fretwork.—C. K. (*Stratford*) writes:—"In WORK, No. 159, page 46, TINSMITH asks for a monogram. I trust this one may suit him."



R. F. Fret Monogram.

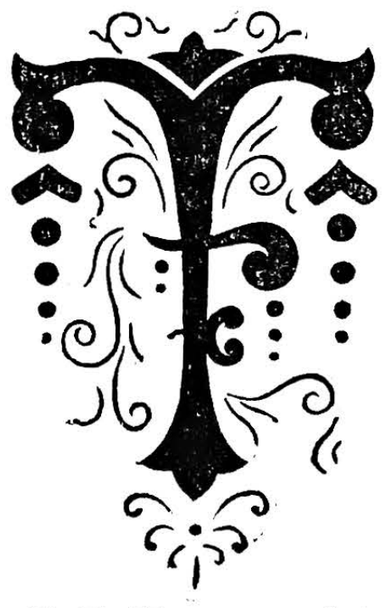
Copal Varnish.—P. E. B. (*Birkenhead*) writes to J. R. E. (*Balolo Mission, Upper Congo*) (see No. 168, page 188):—"I make a very good varnish from gum-copal in the most easy manner possible—viz., by putting the copal into a bottle and adding methylated spirits. In a few days it will have dissolved; strain through muslin, and it is ready for use. There is always a sediment left which never dissolves, to be thrown away."

Small Power Engine Castings.—M. (*Bishop Auckland*) writes to HALIFAX (see No. 166, page 158):—"The Dronfield Casting Company, Sheffield, supply malleable iron castings. You might procure what you require from them."

Fretwork.—M. (*Bishop Auckland*) writes to J. MCC. (*North Brixton*) (see No. 168, page 190):—"The following may suit you: 'Fret-sawing and Marquetry-cutting' (Ward, Lock, Bowden & Co.)."

Tin—Geometry.—M. (*Bishop Auckland*) writes to YOUNG READER (see No. 168, page 190):—"If you can burn off all the tin and solder, you might sell them for scrap iron, but it may cost as much as you will get for them. The following book may suit you: 'Descriptive Geometry,' by J. F. Heather (Crosby Lockwood & Son)."

Monogram F. T. for Painting.—C. K. (*Stratford*) writes:—"In WORK, No. 161, p. 78, E. A. T. (*Burnham*) asks for a monogram. I trust this one may suit him."



F. T. Monogram for Painting.

Slide Rule.—M. (*Bishop Auckland*) writes to W. W. (*Carbrook*) (see No. 166, page 158):—"If the book is out of print you might obtain a copy from Mr. Batsford, 52, High Holborn. Would one of the following be suitable? 'The Slide Rule,' by Lieut.-Col. J. R. Campbell, price 1s. (Spon, Strand); or 'The Slide Rule,' by Charles Hoare, 2s. 6d. (Crosby Lockwood & Son)."

Division Plate.—M. (*Bishop Auckland*) writes to DRILL (see No. 170, page 222):—"You will find a description of the division plate on page 153, Vol. I. of WORK. If you have not this, one of the following books will perhaps suit you: 'Geometric Turning Simplified,' by J. Lukin; or 'Ornamental Turning,' by J. H. Evans (Spon, 125, Strand)."

Picture Restoring.—M. (*Bishop Auckland*) writes to J. H. (*Edinburgh*) (see No. 170, page 222):—"If your picture is a good one, you had better get it cleaned by a professional cleaner, as in trying to remove the varnish you might spoil the picture."

Red and Green Fire.—W. B. (*Golcar*) writes, in reply to A. J. W. (*Battersea*) (see No. 160, page 62):—"I beg to give recipes for green fire of any calibre. Use 16 oz. meal powder and 3½ oz. of fine copper filings. Red fire is made from 40 parts of dry nitrate of strontium, 13 parts of finely-powdered sulphur, 5 parts of chlorate of potash, and 4 parts of sulphate of antimony. The ingredients may be pounded together in a mortar, except the chlorate of potash, which must be ground separately. All must be thoroughly mixed; and if the fire should burn dim, a small quantity of charcoal must be added."

Stained Glass Designs.—H. K. (*Hulme*) writes, in answer to J. B. (*Moss Side*) (see No. 172, page 254):—"He can be supplied with designs for the above by writing to 81, Raly Street, Moss Side, Manchester. The price will be according to designs."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—MIDLAND; T. W. W. (*Leeds*); H. T. (*West Bromwich*); A FITTER; T. H. H. (*Birkenhead*); J. A. (*Pendleton*); F. T. G. (*Keighley*); T. W. (*Manchester*); F. H. M. M. (*Alexandria*); IRONWORK; J. W. (*Dundee*); F. T. (*Bristol*); LOVER OF THE SEA; GAEL; J. A. (*Smallheath*); E. C. W. (*Clapham*); ANXIOUS; W. A. L. (*Birmingham*); OVERSEER; W. R. (*Liverpool*); CONSTANT READER; J. R. (*Greenock*); C. J. P. (*South Norwood*).

"WORK" PRIZE SCHEME.

SECOND COMPETITION.

FOR the three best suggestions for a new domestic appliance, household article, or labour-saving tool of general utility, the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

FOR FULL CONDITIONS AND RULES OF THE "USEFUL HOUSEHOLD ARTICLE" COMPETITION SEE PREVIOUS NUMBERS.

ALL Descriptions to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the Prize Scheme is announced.

All manuscripts intended for the "Useful Household Article" Competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him on or before Saturday, July 30, endorsed, "Useful Household Article" Competition.

NOTICE TO READERS.

AMONG next week's contents of WORK (No. 177) will be the following important papers:—

HOW TO MAKE A WARDIAN CASE;
SCREW-CUTTING IN THE LATHE;
PHOTO-PRINTING FRAMES FOR THE MILLION;
ART OF STAIRCASING;
LEATHER WORK AND MODELLING DESIGNS;
HOW TO MAKE AND WORK THE SPECTROSCOPE;
"CYCLE" FIRST PRIZE ESSAY; also
THIRD PRIZE COMPETITION ANNOUNCEMENT.

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Victor Supply Co., Grimsby, sell Mail-cart Wheels and Parts. [15 R

Caplatzi's Cheap Technical Collections embrace most things electrical, optical, mechanical, chemical, photographic, models, materials. Catalogues, 2d.—Chenies Street, Bedford Square. [9 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Darlington Street, Bath. Note.—100 Decorators' Stencils (60 large sheets), 2s. 6d.

100 Fretwork Designs (new), 100 Carving, 100 Repoussé, 30 Fret Brackets, 100 Sign Writers' Stencils (all full size), 300 Turning, 400 Small Stencils. Each packet, 1s.; postage free.—F. COULTHARD, Darlington Street, Bath. [1 S

Picture Moulds.—15 to 25 per cent. saved. Send for wholesale list, one stamp.—DENT'S, Importers, Tamworth. [12 R

Water Motors, from 5s. each; ½ h.-p., price 20s.; list, stamp.—WALTON, 9, Queen Anne St., Stoke-on-Trent.

Goodell Lathe, fretsaw attachment and tools, for sale. Also fret machine made by advertiser; cheap. Letters only.—ROBINSON, 208, Cabe Street, E.

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